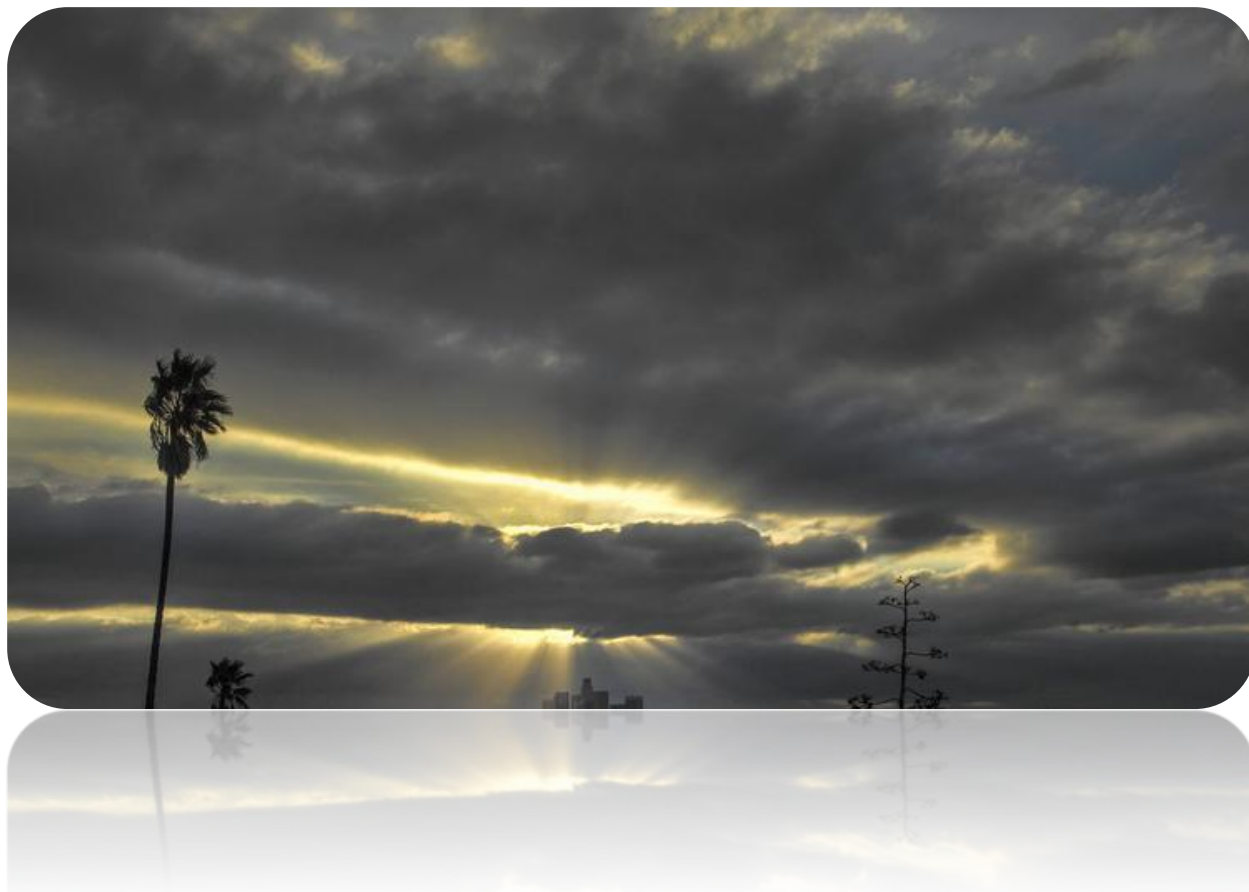


IMPERIAL COUNTY AIR POLLUTION CONTROL DISTRICT



A major storm approaches Los Angeles in December. Though atmospheric rivers are unlikely to end California's drought this year, if they bring enough rain to erase the state's precipitation deficit, they could wreak havoc by unleashing floods and landslides. (Credit: Allen J. Schaben/Los Angeles Times) <https://ktla.com/2015/01/18/california-drought-could-end-with-storms-known-as-atmospheric-rivers/>

December 14, 2015 Exceptional Event Documentation For the Imperial County PM₁₀ Nonattainment Area

FINAL REPORT
October 5, 2018

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ACRONYM DESCRIPTIONS

AOD	Aerosol Optical Depth
AQI	Air Quality Index
AQS	Air Quality System
BACM	Best Available Control Measures
BAM 1020	Beta Attenuation Monitor Model 1020
BLM	United States Bureau of Land Management
BP	United States Border Patrol
CAA	Clean Air Act
CARB	California Air Resources Board
CMP	Conservation Management Practice
DCP	Dust Control Plan
DPR	California Department of Parks and Recreation
EER	Exceptional Events Rule
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GOES-W/E	Geostationary Operational Environmental Satellite (West/East)
HF	Historical Fluctuations
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory Model
ICAPCD	Imperial County Air Pollution Control District
ITCZ	Inter Tropical Convergence Zone
KBLH	Blythe Airport
KCZZ	Campo Airport
KIPL	Imperial County Airport
KNJK	El Centro Naval Air Station
KNYL/MCAS	Yuma Marine Corps Air Station
KPSP	Palm Springs International Airport
KTRM	Jacqueline Cochran Regional Airport (aka Desert Resorts Rgnl Airport)
PST	Local Standard Time
MMML/MXL	Mexicali, Mexico Airport
MODIS	Moderate Resolution Imaging Spectroradiometer
MPH	Miles Per Hour
MST	Mountain Standard Time
NAAQS	National Ambient Air Quality Standard
NCAR	National Center for Atmospheric Research
NCEI	National Centers for Environmental Information
NEAP	Natural Events Action Plan
NEXRAD	Next-Generation Radar
NOAA	National Oceanic and Atmospheric Administration
nRCP	Not Reasonably Controllable or Preventable
NWS	National Weather Service
PDT	Pacific Daylight Time

PM ₁₀	Particulate Matter less than 10 microns
PM _{2.5}	Particulate Matter less than 2.5 microns
PST	Pacific Standard Time
QA/QC	Quality Assured and Quality Controlled
QCLCD	Quality Controlled Local Climatology Data
RACM	Reasonable Available Control Measure

I Introduction

On December 14, 2015, State and Local Ambient Air Monitoring Stations (SLAMS), located in Brawley (AQS Site Code 060250007), El Centro (AQS Site Code 06-25-1003), Niland (AQS Site Code 060254004), and Westmorland (AQS Site Code 060254003), California measured exceedances of the National Ambient Air Quality Standard (NAAQS). All Federal Referenced Method (FRM) Size-Selective Inlet (SSI) High Volume Gravimeter samplers, except the FRM SSI located in Calexico measured 24-hr average (midnight to midnight) Particulate Matter less than 10 microns (PM₁₀) concentrations of 222 µg/m³, 165 µg/m³, 250 µg/m³, and 193 µg/m³ (Table 1-1). In addition, all the Federal Equivalent Method (FEM), Beta Attenuation Monitor Model 1020's (BAM 1020), except the FEM BAM 1020 located in Niland, measured 24-hr average (midnight to midnight) PM₁₀ concentrations of 208 µg/m³, 183 µg/m³, and 201 µg/m³ (Table 1-1). PM₁₀ 24-hr measurements above 150 µg/m³ are exceedances of the NAAQS.

TABLE 1-1
CONCENTRATIONS OF PM₁₀ ON DECEMBER 14, 2015

DATE	MONITORING SITE	AQS ID	POC(s)	HOURS	24-HOUR CONCENTRATION µg/m ³	PM ₁₀ NAAQS µg/m ³
12/14/2015	Brawley	06-025-0007	1	24	222	150
12/14/2015	El Centro	06-025-1003	1	24	165	150
12/14/2015	Niland	06-025-4004	1	24	250	150
12/14/2015	Westmorland	06-025-4003	1	24	193	150
12/14/2015	Brawley	06-025-0007	3	22	208	150
12/14/2015	Westmorland	06-025-4003	3	22	183	150
12/14/2015	El Centro	06-025-1003	3	24	201	150
12/14/2015	Niland	06-025-4004	3	20	33	150

*All time referenced throughout this document is in Pacific Standard Time (PST) unless otherwise noted¹

The Imperial County Air Pollution Control District (ICAPCD) has been submitting PM₁₀ data from FRM SSI instruments since 1986 into the United States Environmental Protection Agency's (USEPA) Air Quality System (AQS). Prior to 2013 all continuous measured PM₁₀ data was non-regulatory, thus measured in local conditions. However, by 2013 ICAPCD began formally submitting continuous FEM PM₁₀ data from BAM 1020's into the USEPA managed AQS. Because regulatory consideration of reported data must be in standard conditions, as required by USEPA, all continuous PM₁₀ data since 2013 is regulatory. On December 14, 2015 the Brawley, El Centro, Niland, and Westmorland monitors were impacted by elevated particulate matter caused by the entrainment of fugitive windblown dust from high winds generated by the passing of a low-pressure system associated with a well-defined front through Southern California.

¹ According to the National Institute of Standards and Technology (NIST) Time and Frequency Division the designation of the time of day for specific time zones are qualified by using the term "standard time" or "daylight time". For year-round use, the designation can be left off inferring "local time" daylight or standard whichever is present. For 2015, Pacific Daylight Time (PDT) is March 8 through November 1. <https://www.nist.gov/pml/time-and-frequency-division/local-time-faq#intl>

This report demonstrates that a naturally occurring event caused an exceedance observed on December 14, 2015, which elevated particulate matter and affected air quality. The report provides concentration to concentration monitoring site analyses supporting a clear causal relationship between the event and the monitored exceedances and provides an analysis supporting the not reasonably controllable or preventable (nRCP) criteria. Furthermore, the report provides information that the exceedances would not have occurred without the entrainment of fugitive windblown dust from outlying deserts and mountains within the Sonoran Desert. The document further substantiates the request by the ICAPCD to exclude PM₁₀ 24-hour NAAQS exceedances of 165 µg/m³, 183 µg/m³, 193 µg/m³, 201 µg/m³, 208 µg/m³, 222 µg/m³, and 250 µg/m³ (**Table 1-1**) as an exceptional event. This demonstration substantiates that this event meets the definition of the USEPA Regulation for the Treatment of Data Influenced by Exceptional Events (EER)².

I.1 Demonstration Contents

Section II - Describes the December 14, 2015 event as it occurred in California and into Imperial County, providing background information of the exceptional event and explaining how the event affected air quality. Overall, this section provides the evidence that the event was a natural event.

Section III – Using time-series graphs, summaries and historical concentration comparisons of the Brawley, El Centro, Niland and Westmorland stations this section discusses and establishes how the December 14, 2015 event affected air quality demonstrating that a clear causal relationship exists between the event and the monitored exceedance. It is perhaps of some value to mention that the time-series graphs include PM₁₀ data measured in both local conditions and standard conditions. Measured PM₁₀ continuous data prior to 2013 is in local conditions, all other data is in standard conditions. The concentration difference between local and standard conditions has an insignificant impact on any data analysis. Overall, this section provides the evidence that human activity played little or no direct causal role in the December 14, 2015 event and its resulting emissions defining the event as a “natural event”.³

Section IV - Provides evidence that the event of December 14, 2015 was not reasonably controllable or preventable despite the full enforcement and implementation of Best Available Control Measures (BACM).

Section V - Brings together the evidence presented within this report to show that the exceptional event affected air quality; that the event was not reasonably controllable or preventable; that there was a clear causal relationship between the event and the exceedance, and that the event was a natural event.

² "Treatment of Data Influenced by Exceptional Events; Final Guidance", 81 FR 68216, October 2, 2016

³ Title 40 Code of Federal Regulations part 50: §50.1(k) Natural event means an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. For purposes of the definition of a natural event, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions.

I.2 Requirement of the Exceptional Event Rule

The above sections combined comprise the technical requirements described under the Exceptional Events Rule (EER) under 40 CFR §50.14(c)(3)(iv). However, in order for the USEPA to concur with flagged air quality monitoring data, there are additional non-technical requirements.

I.2.a Public Notification that a potential event was occurring (40 CFR §50.14(c)(1))

The ICAPCD published the National Weather Service (NWS) San Diego and Phoenix offices synopsis for the weekend covering December 11, 2015 through December 14, 2015. The published notification advised the public that a Pacific cold front would be moving through Southern California with strong west winds, rain and snow showers, and colder conditions. The notification indicated that the strongest winds would be along the ridges of the San Diego and Riverside County Mountains. Because of the potential for suspended particles and poor air quality the ICAPCD declared a "Limited Burn" day for December 13, 2015 and a "No Burn" day for December 14, 2015. **Appendix A** contains copies of notices pertinent to the December 14, 2015 event.

I.2.b Initial Notification of Potential Exceptional Event (INPEE) (40 CFR §50.14(c)(2))

States are required under federal regulation to submit measured ambient air quality data into the AQS. AQS is the federal repository of Quality Assured and Quality Controlled (QA/QC) ambient air data used for regulatory purposes. When States intend to request the exclusion of one or more exceedances of a NAAQS as an exceptional event a notification to the Administrator is required. Notification occurs when an agency submits a request, which includes an initial event description, for flagging data in AQS.

On October 3, 2016, the US EPA promulgated revisions to the Exceptional Events rule, which included the requirement of an "Initial Notification of Potential Exceptional Event" (INPEE) process. This revised INPEE process requires communication between the US EPA regional office and the State, prior to the development of a demonstration. The intent of the INPEE process is twofold: to determine whether identified data may affect a regulatory decision and whether a State should develop/submit an EE Demonstration.

The ICAPCD made a formal written request to the California Air Resources Board (CARB) to place preliminary flags on SLAMS measured PM₁₀ concentration from the Brawley, Niland, Westmorland and El Centro monitors on March 7, 2016. Subsequently there after the ICAPCD sent a revised request on March 18, 2016 providing additional information describing the event. **Table 1-1** above provides the correct concentration for Brawley, Niland, Westmorland and El Centro. The difference in concentrations between local and standard has an insignificant impact on any data analysis. The submitted request included a brief description of the meteorological conditions for December 14, 2015 indicating that a potential natural event occurred.

I.2.c Documentation that the public comment process was followed for the event demonstration that was flagged for exclusion (40 CFR §50.14(c)(3)(v))

The ICAPCD posted, for a 30-day public review, a draft version of this demonstration on the ICAPCD webpage and published a notice of availability in the Imperial Valley Press on March 12, 2018. The published notice invited comments by the public regarding the request, by the ICAPCD, to exclude the measured concentrations of 222 $\mu\text{g}/\text{m}^3$, 165 $\mu\text{g}/\text{m}^3$, 250 $\mu\text{g}/\text{m}^3$, 193 $\mu\text{g}/\text{m}^3$, 208 $\mu\text{g}/\text{m}^3$, 183 $\mu\text{g}/\text{m}^3$ and 201 $\mu\text{g}/\text{m}^3$ (**Table 1-1**), which occurred on December 14, 2015 in Niland, Brawley, Westmorland and El Centro. The final closing date for comments was April 11, 2018. **Appendix A** contains a copy of the public notice affidavit along with any comments received by the ICAPCD for submittal as part of the demonstration (40 CFR §50.14(c)(3)(v)).

I.2.d Documentation submittal supporting an Exceptional Event Flag (40 CFR §50.14(c)(3)(i))

States that have flagged data as a result of an exceptional event and who have requested an exclusion of said flagged data are required to submit a demonstration that justifies the data exclusion to the USEPA in accordance with the due date established by USEPA during the INPEE process (40 CFR §50.14(c)(2)). Currently, bi-weekly meetings between USEPA, CARB and Imperial County are set to discuss each flagged exceedance for 2015.

The ICAPCD, after the close of the comment period and after consideration of the comments will submit this demonstration along with all required elements, including received comments and responses to USEPA Region 9 in San Francisco, California. The submittal of the December 14, 2015 demonstration will have a regulatory impact upon the development and ultimate submittal of the PM_{10} State Implementation Plan for Imperial County in 2018.

I.2.e Necessary demonstration to justify an exclusion of data under (40 CFR §50.14(c)(3)(iv))

- A This demonstration provides evidence that the event, as it occurred on December 14, 2015 satisfies the definition in 40 CFR §50.1(j) and (k) for an exceptional event.
 - a The event created the meteorological conditions that entrained emissions and caused the exceedance.
 - b The event clearly “affects air quality” such that there is the existence of a clear causal relationship between the event and the exceedance.
 - c Analysis demonstrates that the event influenced concentrations compared to concentrations at the same monitor at other times supports the clear causal relationship.
 - d The event “is not reasonably controllable and not reasonably preventable.”
 - e The event is “caused by human activity that is unlikely to recur at a particular location or [is] a natural event.”
 - f The event is a “natural event” where human activity played little or no direct causal role.

- B This demonstration provides evidence that the exceptional event affected air quality in Imperial County by demonstrating a clear causal relationship between the event and the measured concentrations in Brawley, El Centro, Niland and Westmorland.
- C This demonstration provides evidence of the measured concentrations to concentrations at the same monitor at other times supporting the clear causal relationship between the event and the affected monitor.

II December 14, 2015 Conceptual Model

This section provides a summary description of the meteorological and air quality conditions under which the December 14, 2015 event unfolded in Imperial County. The subsection elements include

- » A description and map of the geographic setting of the air quality and meteorological monitors
- » A description of Imperial County's climate
- » An overall description of meteorological and air quality conditions on the event day.

II.1 Geographic Setting and Monitor Locations

According to the United States Census Bureau, Imperial County has a total area of 4,482 square miles of which 4,177 square miles is land and 305 square miles is water. Much of Imperial County is below sea level and is part of the Colorado Desert an extension of the larger Sonoran Desert (Figure 2-1). The Colorado Desert not only includes Imperial County but a portion of San Diego County.

FIGURE 2-1
COLORADO DESERT AREA IMPERIAL COUNTY



Fig 2-1: 1997 California Environmental Resources Evaluation System. According to the United States Geological Survey (USGS) Western Ecological Research Center the Colorado Desert bioregion is part of the bigger Sonoran Desert Bioregion which includes the Colorado Desert and Upper Sonoran Desert sections of California and Arizona, and a portion of the Chihuahuan Basin and Range Section in Arizona and New Mexico (Forest Service 1994)

A notable feature in Imperial County is the Salton Sea, which is at approximately 235 feet below sea level. The Chocolate Mountains are located east of the Salton Sea and extend in a northwest-southeast direction for approximately 60 miles (**Figure 2-2**). In this region, the geology is dominated by the transition of the tectonic plate boundary from rift to fault. The southernmost strands of the San Andreas Fault connect the northern-most extensions of the East Pacific rise. Consequently, the region is subject to earthquakes and the crust is being stretched, resulting in a sinking of the terrain over time.

FIGURE 2-2
SURROUNDING AREAS OF THE SALTON SEA



Fig 2-2: Image courtesy of the Image Science and Analysis Laboratory NASA Johnson Space Center, Houston Texas

All of the seven incorporated cities, including the unincorporated township of Niland, are surrounded by agricultural fields to the north, east, west and south (**Figure 2-6**). Together, the incorporated cities, including Niland, and the agricultural fields make what is known as the Imperial Valley. Surrounding the Imperial Valley are desert areas found on the eastern and western portions of Imperial County.

The desert area, found within the western portion of Imperial County is of note because of its border with San Diego County. From west to east, San Diego County stretches from the Pacific Ocean to its boundary with Imperial County. San Diego County has a varied topography. On its western side is 70 miles (110 km) of coastline. Most of San Diego between the coast and the Laguna Mountains consists of hills, mesas, and small canyons. Snow-capped (in winter) mountains rise to the northeast, with the Sonoran Desert to the far east. Cleveland National

Forest is spread across the central portion of the county, while the Anza-Borrego Desert State Park occupies most of the northeast. The southeastern portion of San Diego County is comprised of distinctive Peninsular mountain ranges. The mountains and deserts of San Diego comprise the eastern two-thirds of San Diego County and are primarily undeveloped back county with a native plant community known as chaparral. Of the nine major mountain ranges within San Diego County, the In-Ko-Pah Mountains and the Jacumba Mountains border Mexico and Imperial County.

Both mountain ranges provide the distinctive weathered dramatic piles of residual boulders that can be seen while driving Interstate 8 from Imperial County through Devil's Canyon and In-Ko-Pah Gorge. Interstate 8 runs along the US border with Mexico from San Diego's Mission Bay to just southeast of Casa Grande Arizona.

FIGURE 2-3
JACUMBA PEAK



Fig 2-3: The Jacumba Mountains reach an elevation of 4,512 feet (1,375 m) at Jacumba Peak, near the southern end of the chain. Source: Wikipedia at https://en.wikipedia.org/wiki/Jacumba_Mountains

Northwest and northeast of the Jacumba Mountains is the Tierra Blanca Mountains, the Sawtooth Mountains and Anza-Borrego Desert State Park. Within the mountain ranges and the Anza-Borrego Desert State Park, there exists the Vallecito Mountains, the Carrizo Badlands, the Carrizo Impact Area, Coyote Mountains and the Volcanic Hills to name of few. Characteristically, these areas all have erosion that has occurred over time that extends from the Santa Rosa Mountains into northern Baja California in Mexico. For example, the Coyote Mountains consists of sand dunes left over from the ancient inland Sea of Cortez. Much of the terrain is still loose dirt, interspersed with sandstone and occasional quartz veins. The nearest community to the Coyote Mountain range is the community of Ocotillo. Of interest are the fossilized and hollowed out sand dunes that produce wind caves.

FIGURE 2-4
ANZA-BORREGO DESERT STATE PARK
CARRIZO BADLANDS



Fig 2-4: View southwest across the Carrizo Badlands from the Wind Caves in Anza-Borrego Desert State Park. Source: Wikipedia at https://en.wikipedia.org/wiki/Carrizo_Badlands

The Carrizo Badlands, which includes the Carrizo Impact Area used by the US Navy as an air-to-ground bombing range during World War II and the Korean War, lies within the Anza-Borrego Desert State Park. The Anza-Borrego Desert State Park is located within the Colorado Desert, is the largest state park in California occupying eastern San Diego County, reaching into Imperial and Riverside counties. The two communities within Anza-Borrego Desert State Park are Borrego Springs and Shelter Valley.

The Anza-Borrego Desert State Park lies in a unique geologic setting along the western margin of the Salton Trough. The area extends north from the Gulf of California to San Geronio Pass and from the eastern rim of the Peninsular Ranges eastward to the San Andreas Fault zone along the far side of the Coachella Valley. The Anza-Borrego region changed gradually over time from intermittently being fed by the Colorado River Delta to dry lakes and erosion from the surrounding mountain ranges. The area located within the southeastern and northeastern section of San Diego County is a source of entrained fugitive dust emissions that impact Imperial County when westerly winds funnel through the unique landforms causing in some cases wind tunnels that cause increases in wind speeds.

Historical observations have indicated that the desert slopes and mountains of San Diego are a source of fugitive emissions along with those deserts located to the east and west of Imperial County, which extend into Mexico (Sonoran Desert, **Figure 2-7**). Combined, the desert areas and mountains of San Diego and the desert areas that extend into Mexico are sources of dust emissions, which affect the Imperial County during high wind events.

FIGURE 2-5
ANZA-BORREGO DESERT STATE PARK
DESERT VIEW FROM FONT'S POINT



Fig 2-5: Desert view from Font's Point. Source: Font's Point Anza-Borrego Photographed by and copyright of (c) David Corby; Wikipedia at https://en.wikipedia.org/wiki/Anza-Borrego_Desert_State_Park

FIGURE 2-6
LOCATION AND TOPOGRAPHY OF IMPERIAL COUNTY



Fig 2-3: Depicts the seven incorporated cities within Imperial Valley: City of Calipatria, City of Westmorland, City of Brawley, City of Imperial, City of El Centro, City of Holtville, and the City of Calexico. Niland is unincorporated. Mexicali, Mexico is to the south

FIGURE 2-7
DESERTS IN CALIFORNIA, YUMA AND MEXICO

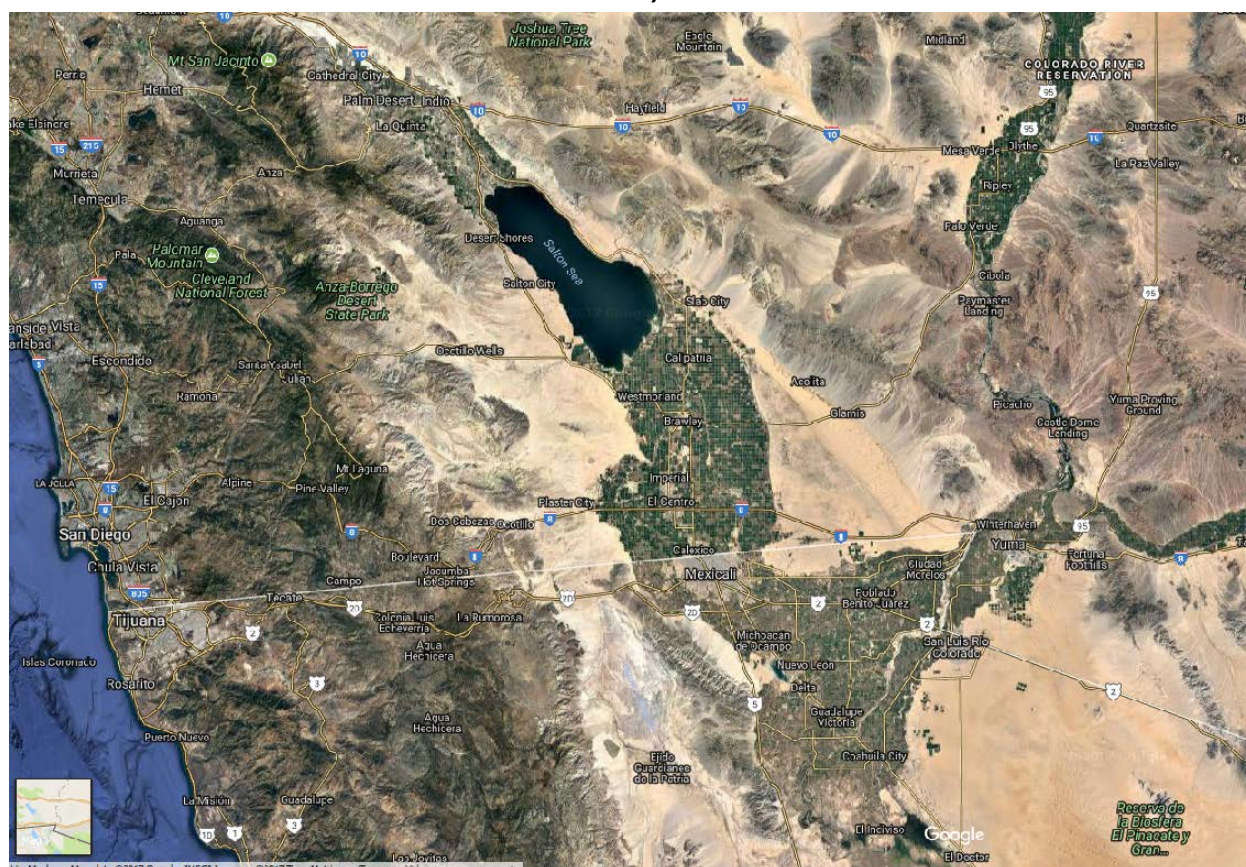


Fig 2-7: Depicts the Sonoran Desert as it extends from Mexico into Imperial County.
 Source: Google Earth Terra Metrics

The air quality and meteorological monitoring stations used in this demonstration are shown in **Figure 2-8**. Of the five SLAMS within Imperial County four stations measure both meteorological and air quality data. These SLAMS are located in Calexico, El Centro, Westmorland, and Niland; the station located in Brawley only measures air quality. Other air monitoring stations measuring air quality and meteorological data used for this demonstration include stations in eastern Riverside County, southeastern San Diego County and southwestern Arizona (Yuma County) (**Figure 2-8 and Table 2-1**).

As mentioned above, the PM_{10} exceedance on December 14, 2015, occurred at the Brawley, Niland, Westmorland and El Centro stations. The Brawley, Niland and Westmorland stations are regarded as the “northern” monitoring sites within the Imperial County air monitoring network. In order to properly analyze the contributions from meteorological conditions occurring on December 14, 2015, other meteorological sites were used in this demonstration which include airports in eastern Riverside County, southeastern San Diego County, southwestern Arizona (Yuma County), Imperial County, and other sites relevant to the wind event, such as within northern Mexico. (**Figure 2-8**).

FIGURE 2-8
MONITORING SITES IN AND AROUND IMPERIAL COUNTY

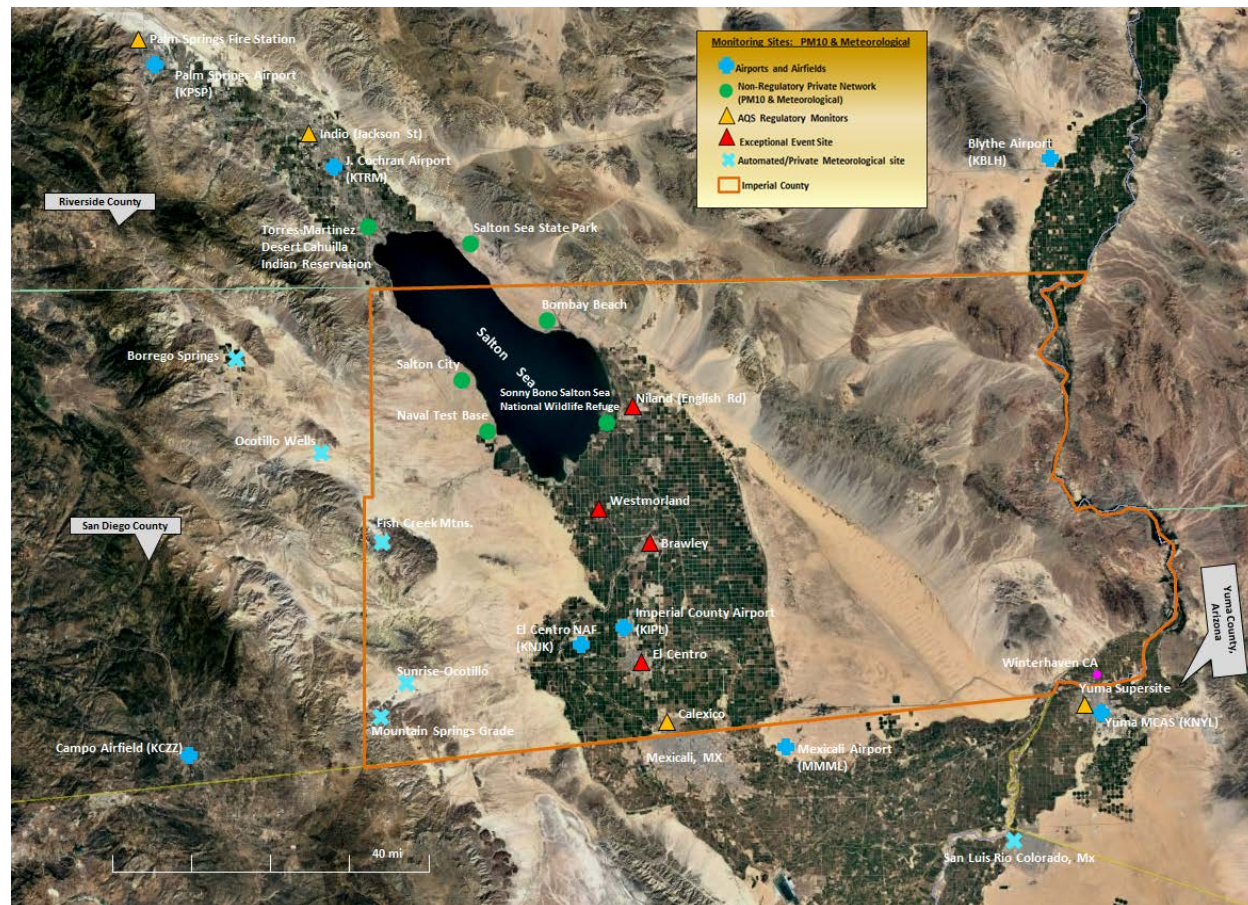


Fig 2-8: Depicts a select group of meteorological and PM₁₀ monitoring sites in Imperial County, eastern Riverside County, southeastern San Diego County, southwestern Arizona (Yuma County), and northern Mexico. The image provides the location of potential sites used to gather data in support an Exceptional Event Demonstration. Source: Google Earth

In addition to meteorological sites, there are non-regulatory PM₁₀ sites located around the Salton Sea that maybe referenced as an aid to help the reader understand the direction and velocity of winds that affect Imperial County. Unless, otherwise specifically indicated concentration references do not imply emissions from the surrounding playa of the Salton Sea. Three sites, in specific, are the Salton City air monitoring station, the Naval Test Base air monitoring station and the Sonny Bono air monitoring station. These privately owned stations are non-regulatory (**Figures 2-9 to 2-12**). The Salton City station is located 33.27275°N latitude and 115.90062°W longitude, on the western edge of the Salton Sea (**Figure 2-9**). The station abuts a water reservoir along the Salton Sea with surrounding chaparral vegetation and unpaved open areas and roads. The Naval Test Base station is located 33.16923°N latitude and 115.85593°W longitude, on the southwestern edge of the Salton Sea (**Figure 2-11**). The station sits on an abandoned US Military site, still owned by the Department of Defense. Unlike the Salton City station, light chaparral

vegetation and sandy open dune areas surround the Naval Test Base station. Directly to the west of the station is an orchard. The Sonny Bono station is located 33.17638°N latitude and 115.62310°W longitude, on the southern portion of the Salton Sea within the Sonny Bono Salton Sea Wildlife Refuge. The Sonny Bono Salton Sea National Wildlife Refuge is 40 miles north of the Mexican border at the southern end of the Salton Sea within the Sonoran Desert. The Refuge has two separate managed units, 18 miles apart. Each unit contains wetland habitats, farm fields, and tree rows. The land of the Salton Sea Refuge is flat, except for Rock Hill, a small, inactive volcano, located near Refuge Headquarters. Bordering the Refuge is the Salton Sea on the north and farmlands on the east, south, and west.

FIGURE 2-9
SALTON CITY AIR MONITORING STATION

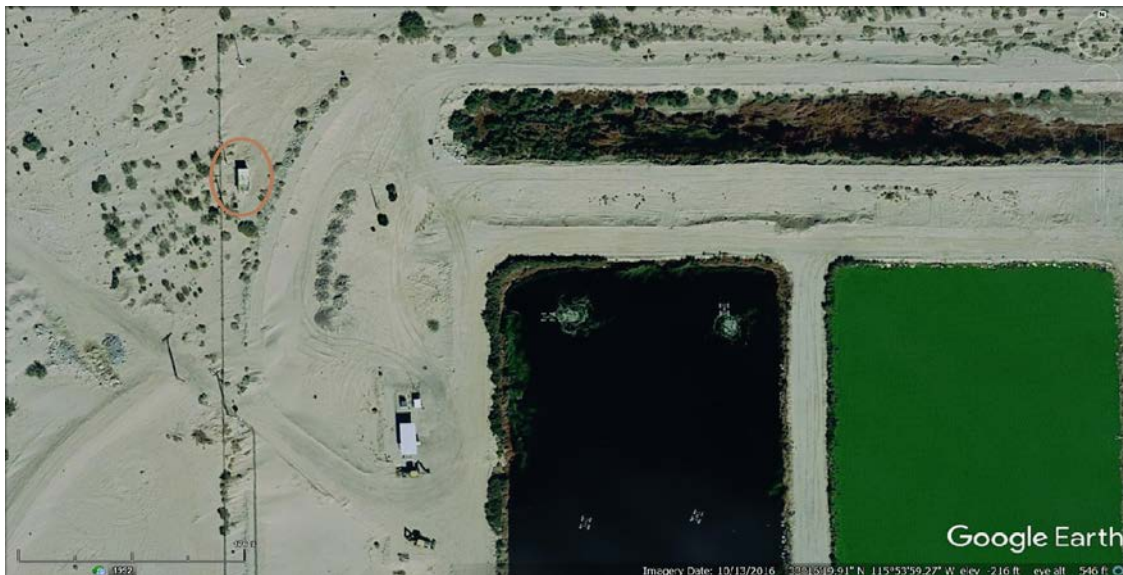


Fig 2-9: Depicts the Salton City air monitoring (circled) site operated by a private entity. Site photos can be seen at the California Air Resources Board monitoring website at https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-10
SALTON CITY AIR MONITORING STATION
WEST



Fig 2-10: Photograph taken by the California Air Resources Board audit team in 2017. The photograph taken from the west facing the probe.
https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-11
NAVAL TEST BASE AIR MONITORING STATION



Fig 2-11: Depicts the Naval Test Base air monitoring (circled) site operated by a private entity. To view the site photos visit the California Air Resources Board monitoring website at https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13603&date=17

FIGURE 2-12
NAVAL TEST BASE AIR MONITORING STATION
WEST



Fig 2-12: Photograph taken by the California Air Resources Board audit team in 2017. The photograph taken from the west facing the probe.
https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-13
SONNY BONO AIR MONITORING STATION



Fig 2-13: Depicts the Sonny Bono air monitoring (circled) site operated by a private entity. To view the site photos visit the California Air Resources Board monitoring website at
https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-14
SONNY BONO SALTON SEA NATIONAL WILDLIFE REFUGE

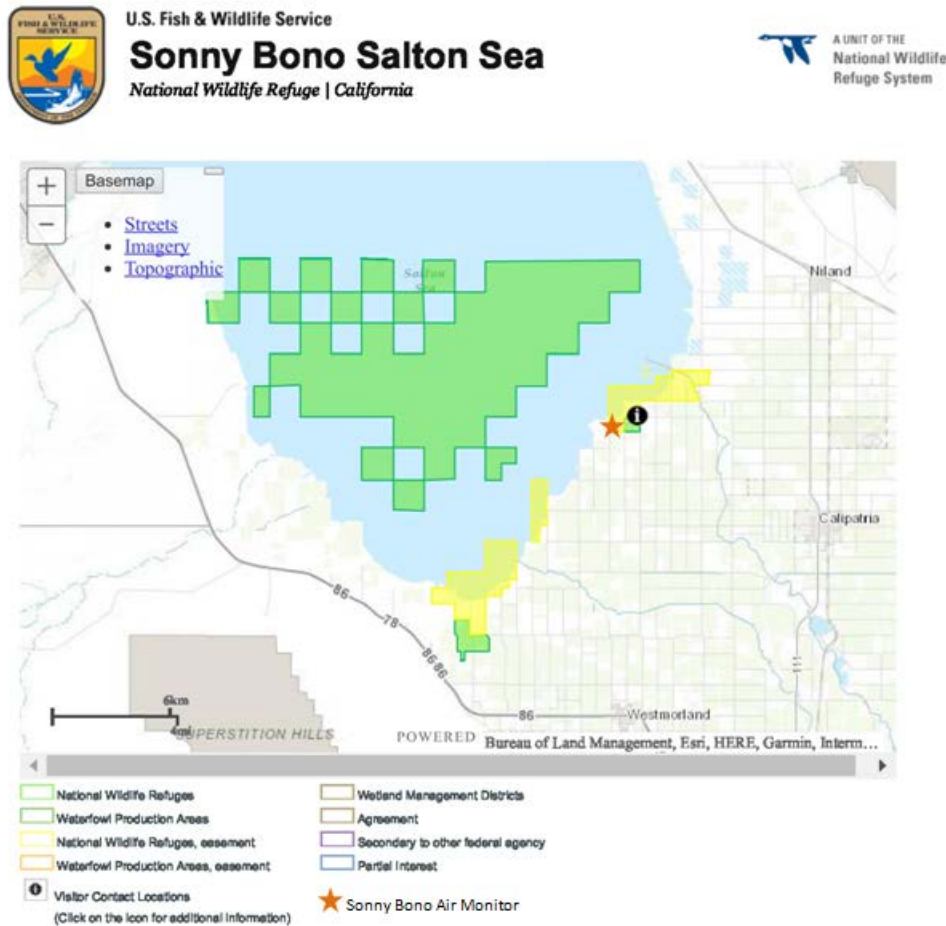


Fig 2-14: The Sonny Bono Wildlife Refuge has about 2,000 acres that are farmed and managed for wetlands. In 1998, the Refuge was renamed after Congressman Sonny Bono, who helped inform the U.S. Congress of the environmental issues facing the Salton Sea as well as acquiring funding for this Refuge to help it respond to avian disease outbreaks and other habitat challenges at the Salton Sea. Source: https://www.fws.gov/refuge/Sonny_Bono_Salton_Sea/about.html

TABLE 2-1
MONITORING SITES IN IMPERIAL COUNTY, RIVERSIDE COUNTY AND ARIZONA
DECEMBER 14, 2015

Monitor Site Name	*Operator	Monitor Type	AQS ID	AQS PARAMETER CODE	ARB Site Number	Elevation (meters)	24-hr PM ₁₀ (µg/m³) Avg	1-hr PM ₁₀ (µg/m³) Max	**Time of Max Reading	Max Wind Speed (mph)	**Time of Max Wind Speed
IMPERIAL COUNTY											
Brawley- Main Street #2	ICAPCD	Hi-Vol Gravimetric	06-025- 0007	(81102)	13701	-15	222	-	-	-	-
		BAM 1020					208	882	0000		
Calexico- Ethel Street	CARB	Hi-Vol Gravimetric	06-025- 0005	(81102)	13698	3	-	-	-	22.6	0400
El Centro-9th Street	ICAPCD	Hi-Vol Gravimetric	06-025- 1003	(81102)	13694	9	165	-	-	16.5	1000
		BAM 1020					201	671	0900		
Niland- English Road	ICAPCD	Hi-Vol Gravimetr	06-025- 4004	(81102)	13997	-57	250	-	-	29.8	0300
		BAM 1020					33	197	400		
Westmorland	ICAPCD	Hi-Vol Gravimetric	06-025- 4003	(81102)	13697	-43	193	-	-		
		BAM 1020					183	984	0300	21.3	0500
RIVERSIDE COUNTY											
Palm Springs Fire Station	SCAQMD	TEOM	06-065- 5001	(81102)	33137	174	11.7	53	0700	-	-
Indio (Jackson St.)	SCAQMD	TEOM	06-065- 2002	(81102)	33157	1	41	178	1100	-	-
ARIZONA – YUMA											
Yuma Supersite	ADEQ	TEOM	04-027- 8011	(81102)	N/A	60	163	786	0500	-	-

*CARB = California Air Resources Board

*ICAPCD = Air Pollution Control District, Imperial County

*SCAQMD = South Coast Air Management Quality District

*ADEQ = Arizona Department of Environmental Quality

**Time represents the actual time/hour of the measurement in question according to the zone time (PST unless otherwise noted)

II.2 Climate

As mentioned above, Imperial County is part of the Colorado Desert, which is a subdivision of the larger Sonoran Desert (**Figure 2-15**) encompassing approximately 7 million acres (28,000 km²). The desert area encompasses Imperial County and includes parts of San Diego County, Riverside County, and a small part of San Bernardino County.

FIGURE 2-15
SONORAN DESERT REGION

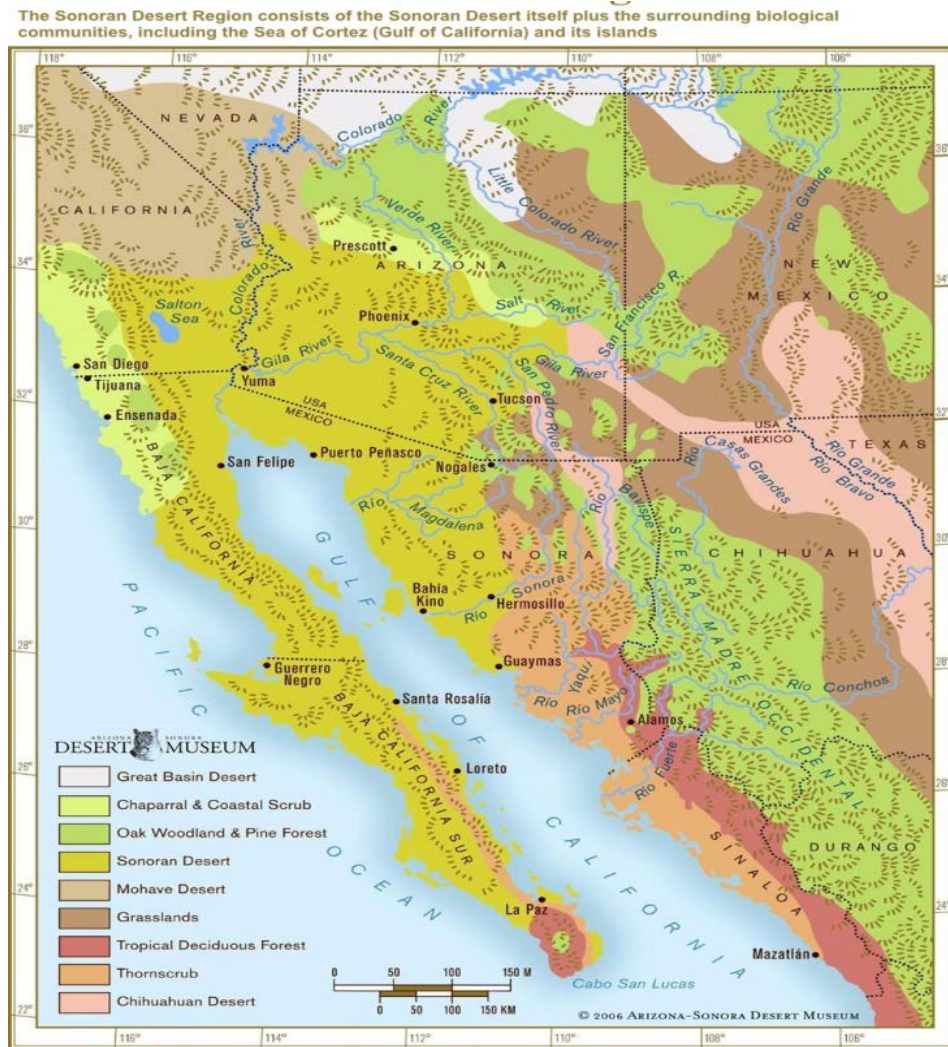


Fig 2-15: Depicts the magnitude of the region known as the Sonoran Desert. Source: Arizona-Sonora Desert Museum at <http://desertmuseum.org/center/map.php>

The majority of the Colorado Desert lies at a relatively low elevation, below 1,000 feet (300 m), with the lowest point of the desert floor at 275 feet (84 m) below sea level at the Salton Sea. Although the highest peaks of the Peninsular Range reach elevations of nearly 10,000 feet (3,000 m), most of the region's mountains do not exceed 3,000 feet (910 m).

In the Colorado Desert (Imperial County), the geology is dominated by the transition of the tectonic plate boundary from rift to fault. The southernmost strands of the San Andreas Fault connect to the northern-most extensions of the East Pacific Rise. Consequently, the region is subject to earthquakes, and the crust is being stretched, resulting in a sinking of the terrain over time.

The Colorado Desert's climate distinguishes it from other deserts. The region experiences greater summer daytime temperatures than higher-elevation deserts and almost never experiences frost. In addition, the Colorado Desert experiences two rainy seasons per year (in the winter and late summer), especially toward the southern portion of the region which includes a portion of San Diego County. The Colorado Desert portion of San Diego County receives the least amount of precipitation. Borrego Springs, the largest population center within the San Diego desert region averages 5 inches of rain with a high evaporation rate. By contrast, the more northerly Mojave Desert usually has only winter rains.

The west coast Peninsular Ranges, or other west ranges, of Southern California—northern Baja California, block most eastern Pacific coastal air and rains, producing an arid climate. Other short or longer-term weather events can move in from the Gulf of California to the south, and are often active in the summer monsoons. These include remnants of Pacific hurricanes, storms from the southern tropical jet stream, and the northern Inter Tropical Convergence Zone (ITCZ).

The arid nature of the region is demonstrated when historic annual average precipitation levels in Imperial County average 3.11" (**Figure 2-16**). During the 12-month period prior to December 14, 2015, Imperial County recorded total annual precipitation of 1.61 inches. Such arid conditions, as those preceding the event, result in soils that are particularly susceptible to particulate suspension by the elevated gusty winds.

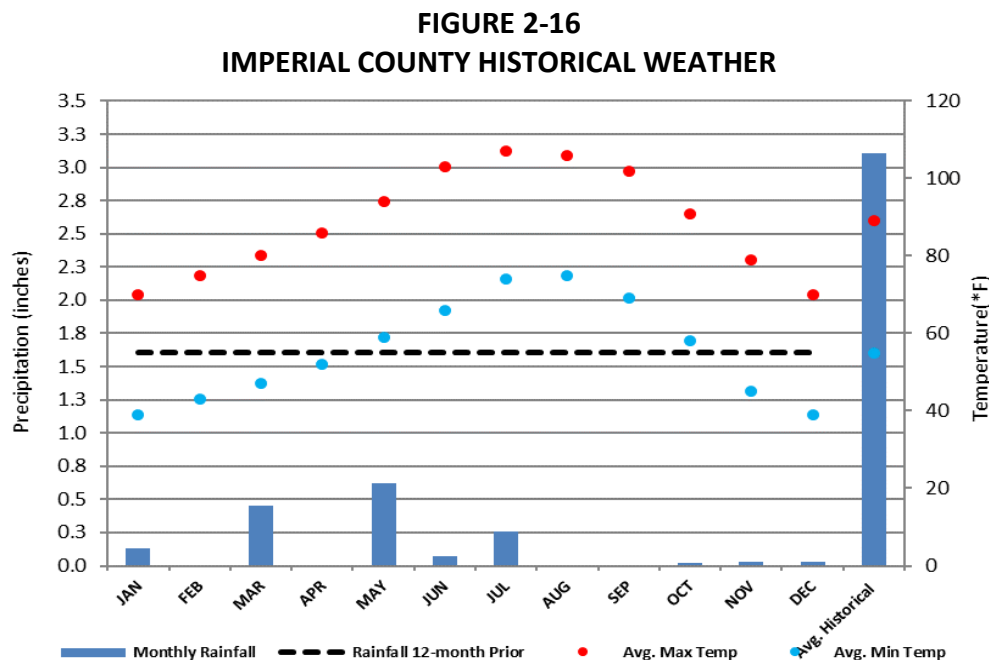


Fig 2-16: Historical Imperial County weather. Prior to December 14, 2015, the region had suffered abnormally low total annual precipitation of 1.61 inches. Average annual precipitation is 3.11 inches. Meteorological data courtesy of Western Regional Climate Center (WRCC) and Weather Underground <http://www.wrcc.dri.edu/cgi-bin/climain.pl?ca2713>

The NWS explains that the speed of any wind resulting from a weather system is directly proportional to the change in air pressure, called a pressure gradient, such that when the pressure gradient increases so does the speed of the wind.⁴ Because the pressure gradient is just the difference in pressure between high and low pressure areas, changes in weather patterns may recur seasonally.

Typically, high pressure brings clear skies and with no clouds, there is more incoming shortwave solar radiation causing temperatures to rise. When surface winds become light, the cooling of the air produced directly under a high-pressure system can lead to a buildup of particulates in urban areas under an elongated region of relatively high atmospheric pressure or ridge causing widespread haze. Conversely, a trough is an elongated region of relatively low atmospheric pressure often associated with fronts. Troughs may be at the surface, or aloft under various conditions. Most troughs bring clouds, showers, and a wind shift, particularly following the passage of the trough.

While windblown dust events in Imperial County during the summer monsoon season are often due to outflow winds from thunderstorms, windblown dust events in the fall, winter, and spring are usually due to strong winds associated with low-pressure systems and cold fronts moving southeast across California. These winds are the result of strong surface pressure gradients between the approaching low-pressure system, accompanying cold front, and higher pressure ahead of it. As the low-pressure system and cold front approaches and passes, gusty southwesterly winds typically shift to northwesterly causing variable west winds. These strong winds entrain dust into the atmosphere and transport it over long distances, especially when soils are arid.

II.3 Event Day Summary

The exceptional event for December 14, 2015, which was caused by strong and gusty west to northwest winds associated with the passing of a low-pressure trough through Southern California as early as the evening hours of December 13, 2015 followed a well-defined front. The well-defined front with strong surface winds moved rapidly past Point Conception during the late afternoon to evening hours of December 13, 2015 with a rather tight height/temperature gradient aloft. During the evening hours of December 13, 2015 through the early morning hours of December 14, 2015 the tight gradients created strong westerly winds which swept across the mountain passes and deserts within San Diego County and into Imperial County affecting air quality and causing an exceedance at the Brawley, El Centro, Niland and Westmorland monitors.

Figures 2-17 through 2-20 provide information regarding the low-pressure trough, cold front, and the resulting strong westerly winds.

⁴ NWS JetStream – Origin of Wind <http://www.srh.noaa.gov/jetstream/synoptic/wind.html>

FIGURE 2-17
UPPER LEVEL TROUGH OVER WESTERN US

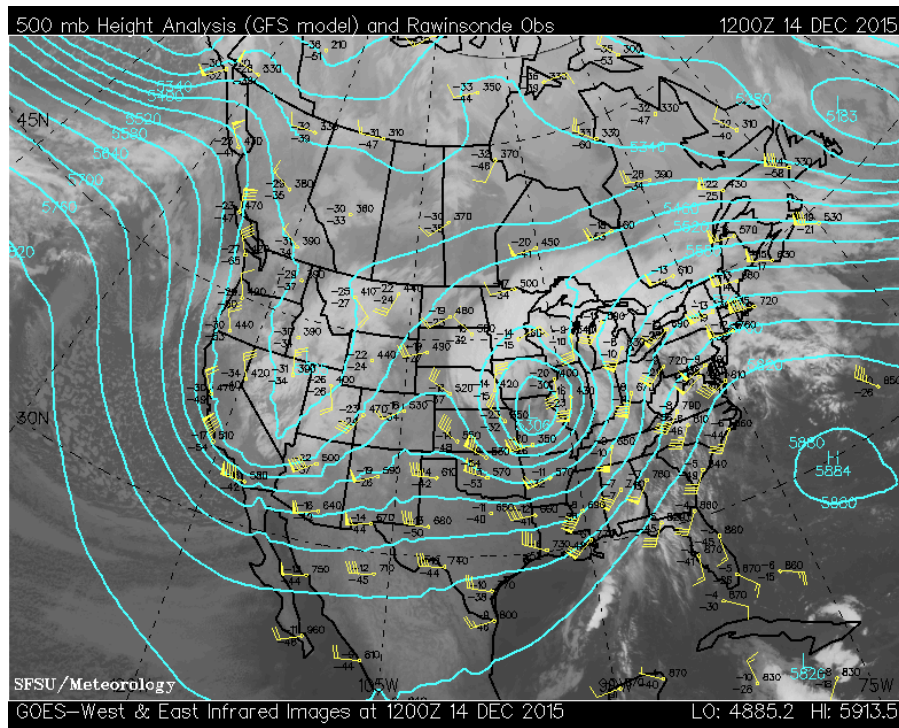


Fig 2-17: A GOES-W infrared satellite image (0400 PST) at the 500mb height level on December 14, 2015, shows the large and deep trough dominating much of the Southwest. Source: SFSU Department of Earth and Climate Sciences and the California Regional Weather Server; http://virga.sfsu.edu/archive/composites/sathts_500/1512

FIGURE 2-18
LARGE COLD FRONT MOVES THROUGH SOUTHERN CA DECEMBER 14, 2015

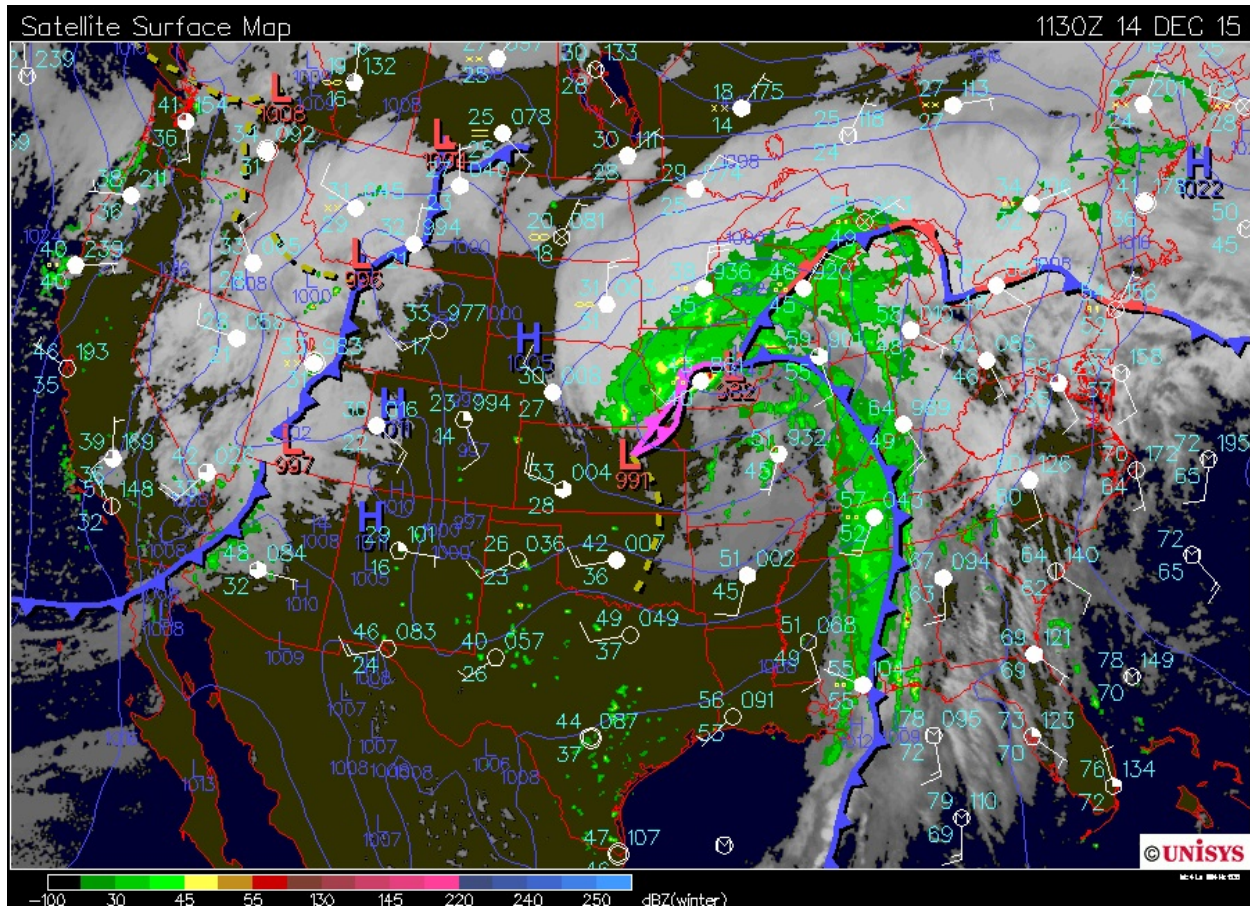


Fig 2-18: A surface composite map (0330 PST) on December 14, 2015 shows a large cold front passing through southeastern California and western Arizona. The system brought a winter storm to southern California and high winds to Imperial County. Monitors at Brawley, El Centro, Niland and Westmorland measured elevated PM₁₀ concentrations during this period. Source: Unisys Corporation

FIGURE 2-19
WEATHER SYSTEM DOMINATES WESTERN US DECEMBER 14, 2015

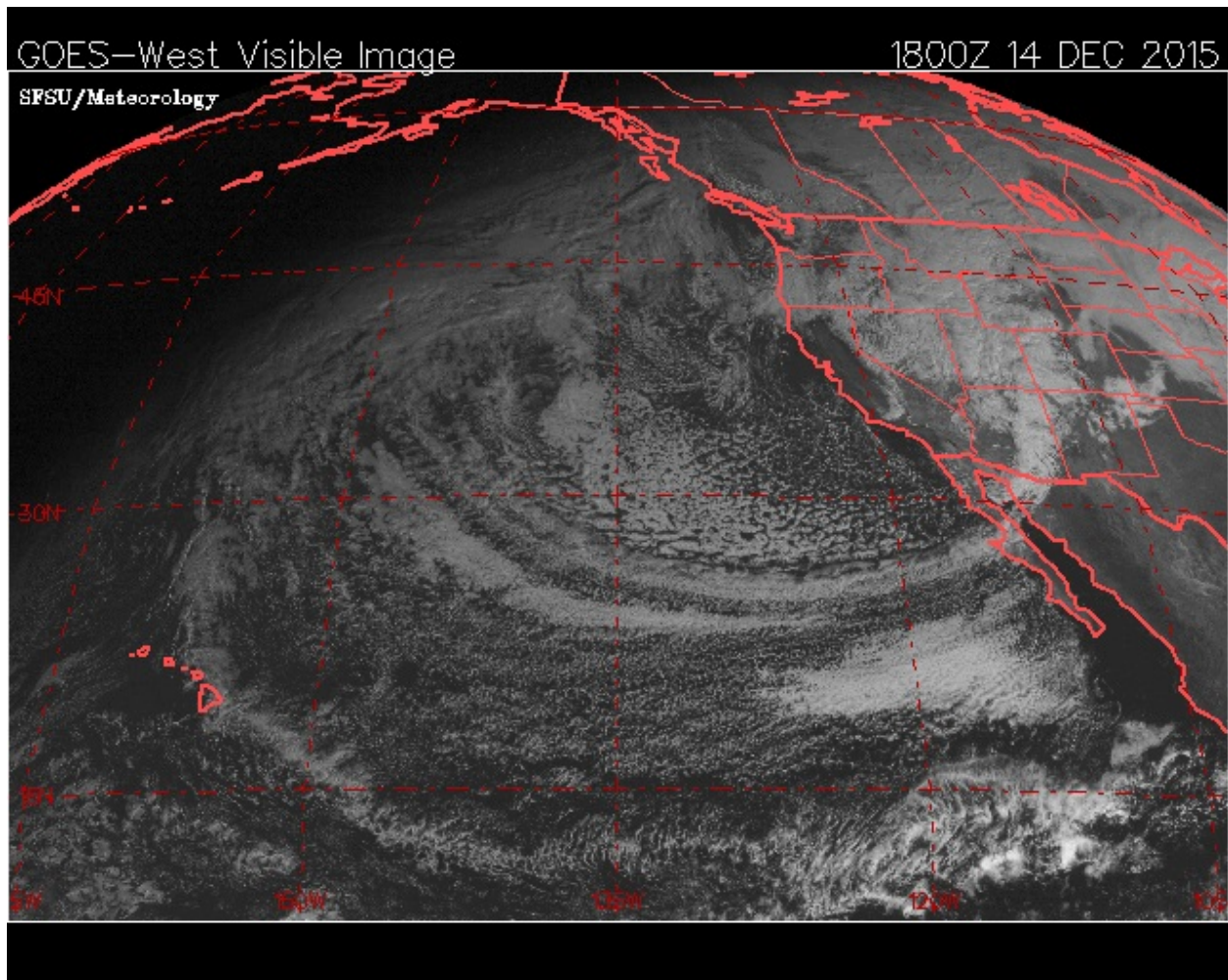


Fig 2-19: A GOES-W satellite image (1100 PST) on December 14, 2015, shows the extent of the weather system over much of the southwest. Source: SFSU Department of Earth and Climate Sciences and the California Regional Weather Server.
http://virga.sfsu.edu/archive/satimgs/gwvis/big/1512/14/15121419_gwvis.gif

FIGURE 2-20
GOES-W SATELLITE VISIBLE INFRARED IMAGES DECEMBER 14, 2015

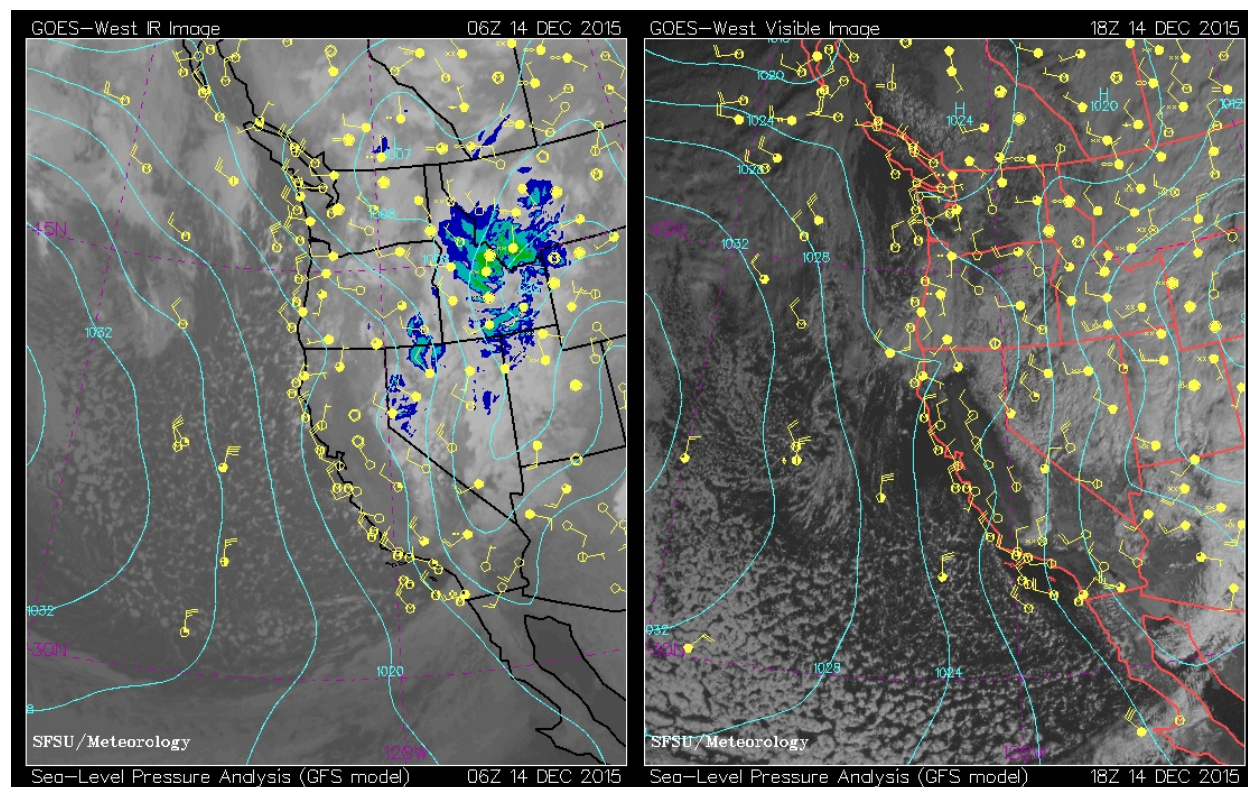


Fig 2-20: A set of infrared (left) and visible (right) GOES-W satellite sea-level pressure analysis images illustrate the general wind direction and wind speed over the region. Left image is at 2200 PST on December 13, 2015, while the right image is 1000 PST. Although wind barbs in these images depict winds from ~17.3 to 28.8 mph both before and after the passage of the frontal system, surface wind stations reported much higher winds. Source: SFSU Department of Earth and Climate Sciences and the California Regional Weather Server. http://squall.sfsu.edu/crws/archive/wcsathts_arch.html

The intensity of the unsettled weather prompted the San Diego and Phoenix NWS offices to issue either Weather Briefings, Urgent Weather Messages and/or Special Weather Statements for areas with San Diego County, including the mountains and deserts and Imperial County. Because the low-pressure trough that passed through the region December 13, 2015 through December 14, 2015 was one of two weather systems, the San Diego NWS office issued Urgent Weather Messages, containing wind advisories, as early as December 12, 2015. By the evening hours of December 12, 2015 winds had calmed however the Area Forecast issued by the San Diego NWS office identified a second winter-like storm system developing out of the Pacific northwest for Sunday December 13, 2015 which would move through Southern California Sunday evening through Monday morning.

By December 13, 2015 the expected cold front was well defined and was expected to create fairly strong and gusty westerly winds within the San Diego mountain slopes and deserts. The

first Urgent Weather Message, issued by the San Diego NWS office at 1341 PST identified southwest to west winds 20 to 30 mph with gusts to 45 mph with hazardous travel warning along Interstate 10 and Interstate 8. In total, the San Diego NWS office issued five Urgent Weather messages through December 14, 2015. The release of preliminary and final Public Statements confirmed strong winds along and within the mountain passes and desert slopes ranging between 40 mph and 59 mph. The NWS office in Phoenix issued on December 14, 2015 a single Special Weather Statement indicating a deep and cold low-pressure system bringing widespread cold temperatures.

Locally, both airports, Imperial County (KIPL) and El Centro NAF (KNJK), measured strong westerly winds and gusts during the early morning hours on December 14, 2015 while stations located within the San Diego Mountains measured elevated winds consistent with forecast models. On December 14, 2015, KNJK and KIPL measured six hours and four hours of winds at or above the 25 mph threshold, respectively. **Figure 2-21** is a graphical illustration of the chain of events for December 14, 2015.

FIGURE 2-21
RAMP UP ANALYSIS DECEMBER 14, 2015

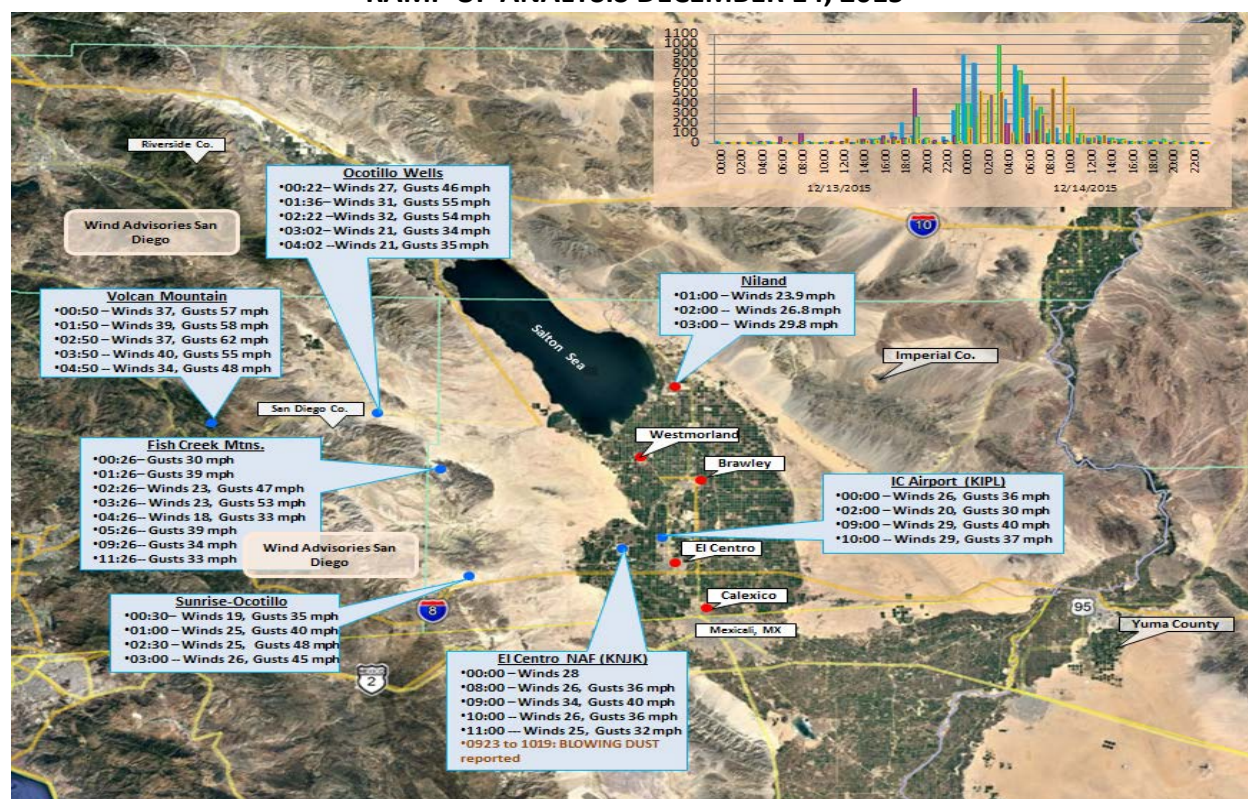


Fig 2-21: Upstream sites within the San Diego Mountains and desert slopes measured winds above the 25 mph threshold. El Centro NAF reported blowing dust from 0923 PST to 1019 PST. Red icons symbolize air quality monitoring sites in Imperial County, while blue indicates meteorological sites. Google Earth base map

Table 2-2 contains a summary of maximum winds, peak wind gusts, and wind direction at monitors in Imperial County, eastern Riverside County, Yuma County, Arizona, and Mexicali. For detailed meteorological station, graphs see **Appendix B**.

TABLE 2-2
WIND SPEEDS ON DECEMBER 14, 2015

Station Monitor	Maximum Wind Speed (WS) (mph)	Wind Direction during Max WS (degrees)	*Time of Max Wind Speed	24 hr Maximum Wind Gust (WG) (mph)	Time of Max WG	PM ₁₀ correlated to time of Max Wind Speed			
Airport Meteorological Data IMPERIAL COUNTY						Brw	EC	Nlnd	Wstmld
Imperial Airport (KIPL)	30	280	946	41	946	160	671	11	28
Naval Air Facility (KNJK)	37	280	927	45	931	160	671	11	28
Calexico (Ethel St)	22.6	271	400	-	-	441	108	197	-
El Centro (9 th Street)	16.5	285	1000	-	-	98	363	9	181
Niland (English Rd)	29.8	255	300	-	-	-	522	-	984
Westmorland	21.3	292	500	-	-	787	257	33	736
RIVERSIDE COUNTY									
Blythe Airport (KBLH)	17	310	852	23	1452	100	555	12	143
Palm Springs Airport (KPSP)	24	310	353	34	253	-	522	-	984
Jacqueline Cochran Regional Airport (KTRM) - Thermal	40	320	152	55	152	813	529	-	272
ARIZONA - YUMA									
Yuma MCAS (KNYL)	26	290	1057	34	1057	98	363	9	181
MEXICALI-MEXICO									
Mexicali Int. Airport (MXL)	24.2	270	1100	-	-	53	91	9	103

*Time represents the actual time/hour of the measurement in question according to the zone time (PST unless otherwise noted)

The Calexico FRM monitor failed to properly sample and no continuous monitor existed for PM₁₀ in Calexico on December 14, 2015

National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory HYSPLIT back trajectory model,⁵ depicted in **Figures 2-22 and 2-23** illustrate the airflow ending at 0000 PST and at 1000 am PST, respectively, on December 14, 2015.

The six-hour back trajectory ending at Brawley, El Centro and Westmorland at 0000 PST on December 14, 2015 is coincident with elevated concentrations of PM₁₀ at all monitors.⁶ The 12-hour back trajectory ending at all stations indicates a slight shift in airflow. Both models illustrate that airflow was westerly when strong winds transported dust particles from natural areas within the mountain and desert regions to the west of Imperial County, affecting PM₁₀ monitors throughout southeastern California. The trajectories illustrate a typical scenario when west winds (airflow) funnel through the mountain passes, many times increasing in speed, and down the desert slopes of San Diego County onto the valley floor. Strong westerly winds typically blow through these mountain passes and desert slopes entraining PM₁₀ across the desert floor and

⁵ The Hybrid Single Particle Lagrangian Integrated Trajectory Model (**HYSPLIT**) is a computer model that is a complete system for computing simple air parcel trajectories to complex dispersion and deposition simulations. It is currently used to compute air parcel trajectories and dispersion or deposition of atmospheric pollutants. One popular use of HYSPLIT is to establish whether high levels of air pollution at one location are caused by transport of air contaminants from another location. HYSPLIT's back trajectories, combined with satellite images (for example, from NASA's [MODIS](#) satellites), can provide insight into whether high air pollution levels are caused by local air pollution sources or whether an air pollution problem was blown in on the wind. The initial development was a result of a joint effort between NOAA and Australia's Bureau of Meteorology. Source: NOAA/Air Resources Laboratory, 2011.

⁶ The Niland monitor did not meet critical criteria requirement for the first four am hours on December 14, 2015.

agricultural lands within Imperial County. It is of some worth to point out that from time to time modeled winds differ from local conditions. Data used in the HYSPLIT model has a horizontal resolution of 12 km and integrated every three hours. Thus, the HYSPLIT model may differ from local observed surface wind speeds and directions.

FIGURE 2-22

HYSPLIT MODEL ENDING 0000 PST DECEMBER 14, 2015

NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 14 Dec 15
NAM Meteorological Data

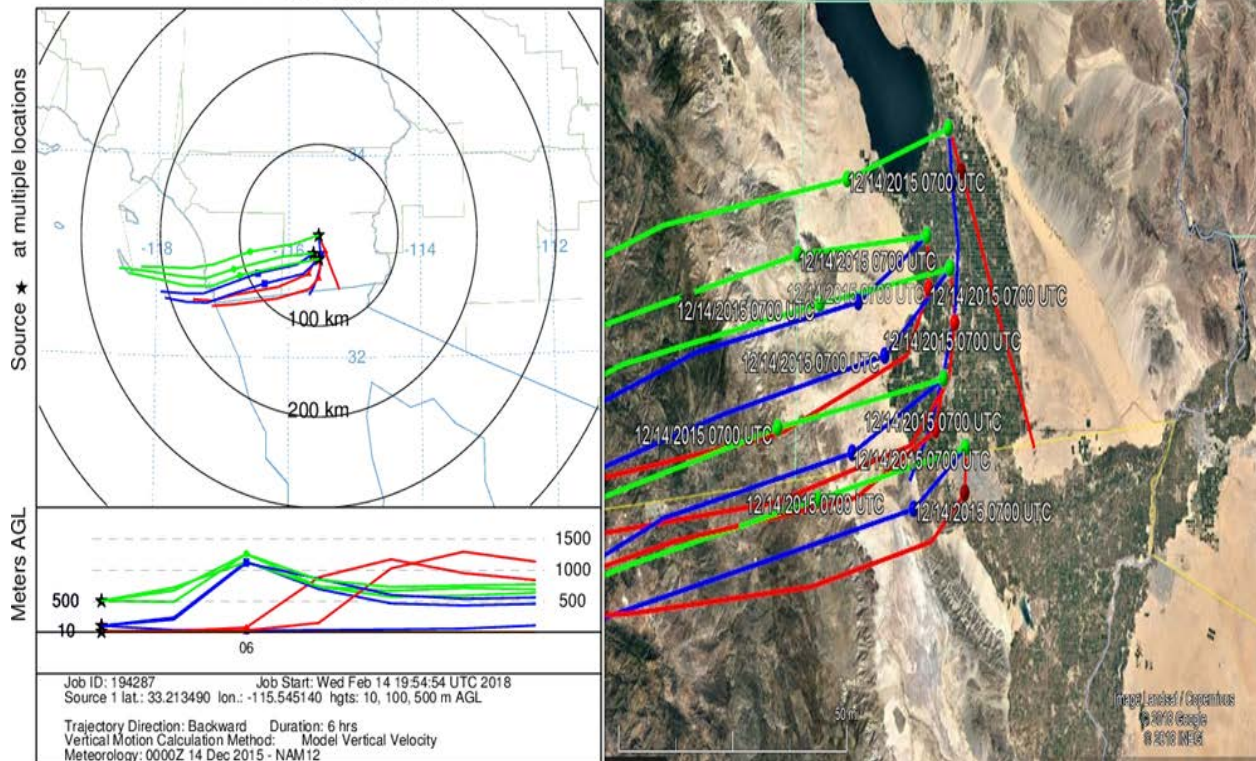


Fig 2-22: A six-hour HYSPLIT back-trajectory model ending at El Centro, Brawley, and Westmorland at 0000 PST on December 14, 2015 (left image) coincident with elevated measurements of PM₁₀ at all monitors. Red lines indicate airflow up to 10 meters AGL (above ground level); blue lines are 100 meters AGL; green lines are 500 meters AGL. HYSPLIT dynamically generated through NOAA's Air Resources Laboratory

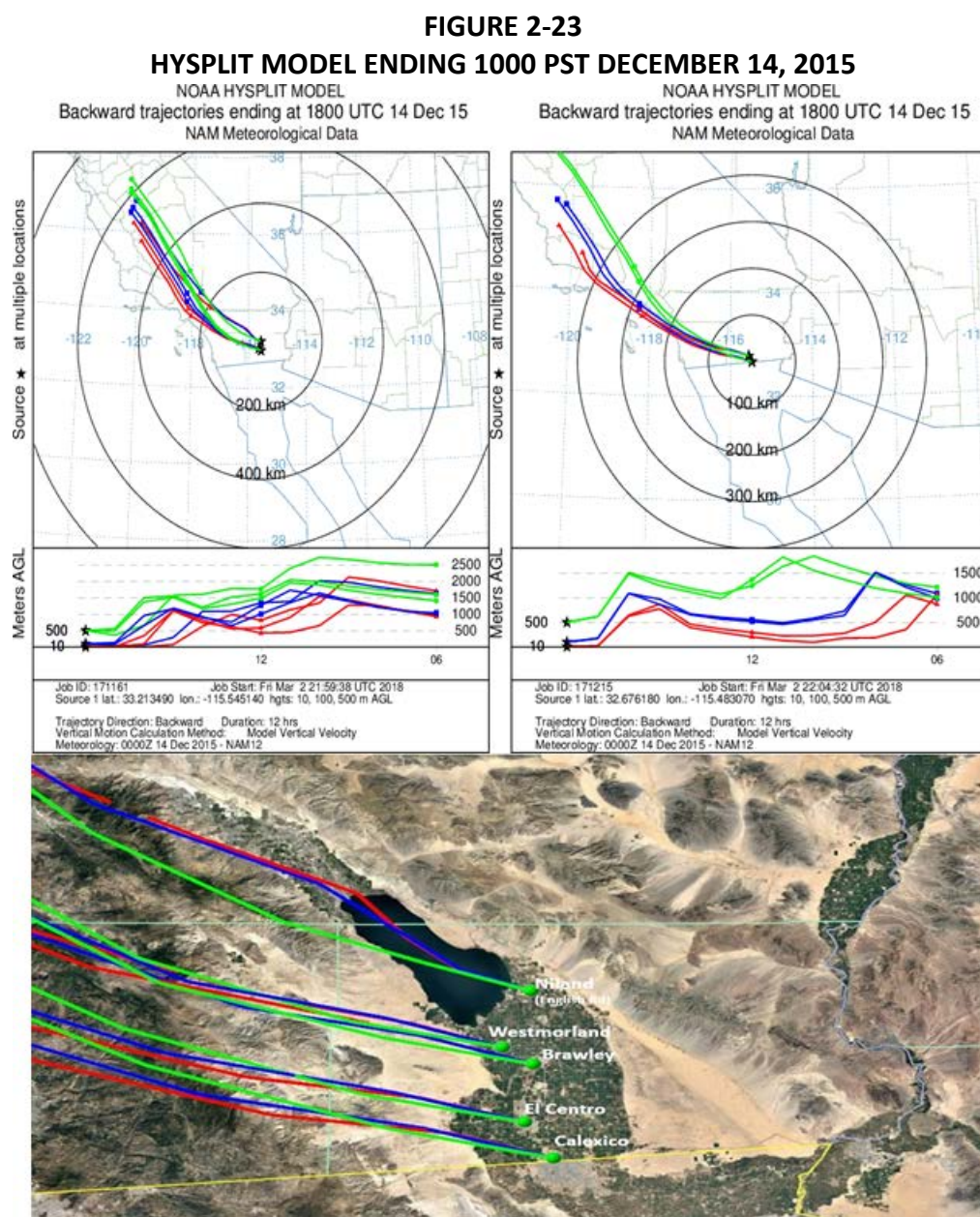


Fig 2-23: A 12-hour HYSPLIT back-trajectory model ending at all monitors at 1000 on December 14, 2015 (top images). A slight change in airflow direction allowed for continued elevated concentrations of particulate matter into Imperial County. Red lines indicate airflow up to 10 meters AGL (above ground level); blue lines are 100 meters AGL; green lines are 500 meters AGL. HYSPLIT dynamically generated through NOAA's Air Resources Laboratory

Figures 2-24 and 2-25 illustrate the elevated winds and elevated levels of hourly PM_{10} concentrations measured in Riverside, Imperial and Yuma Counties for a total of three days, December 13, 2015 through December 15, 2015. Elevated emissions entrained into Imperial County affected the Brawley, Niland, Westmorland and El Centro monitors when gusty west

winds, associated with the passage of a low-pressure system and surface trough situated over California passed through Imperial County as early as the evening of December 13, 2015. The Brawley, Niland, Westmorland and El Centro monitors measured the highest elevated concentrations between 0000 PST and 1000 PST coincident with continual measured wind speeds above 25 mph, with more than one hour at or above 25 mph, and a peak gust of 45 mph.

The resulting entrained dust and accompanying high winds from the system qualify this event as a “high wind dust event”.⁷ High wind dust events are considered natural events where the windblown dust is either from solely a natural source or from areas where anthropogenic sources of windblown dust are controlled with Best Available Control Measures (BACM). The following sections provide evidence that the December 14, 2015 high wind event qualifies as a natural event and that BACM was overwhelmed by the suddenness and intensity of the meteorological event.

FIGURE 2-24
72 HOUR WIND SPEEDS AT VARIOUS SITES

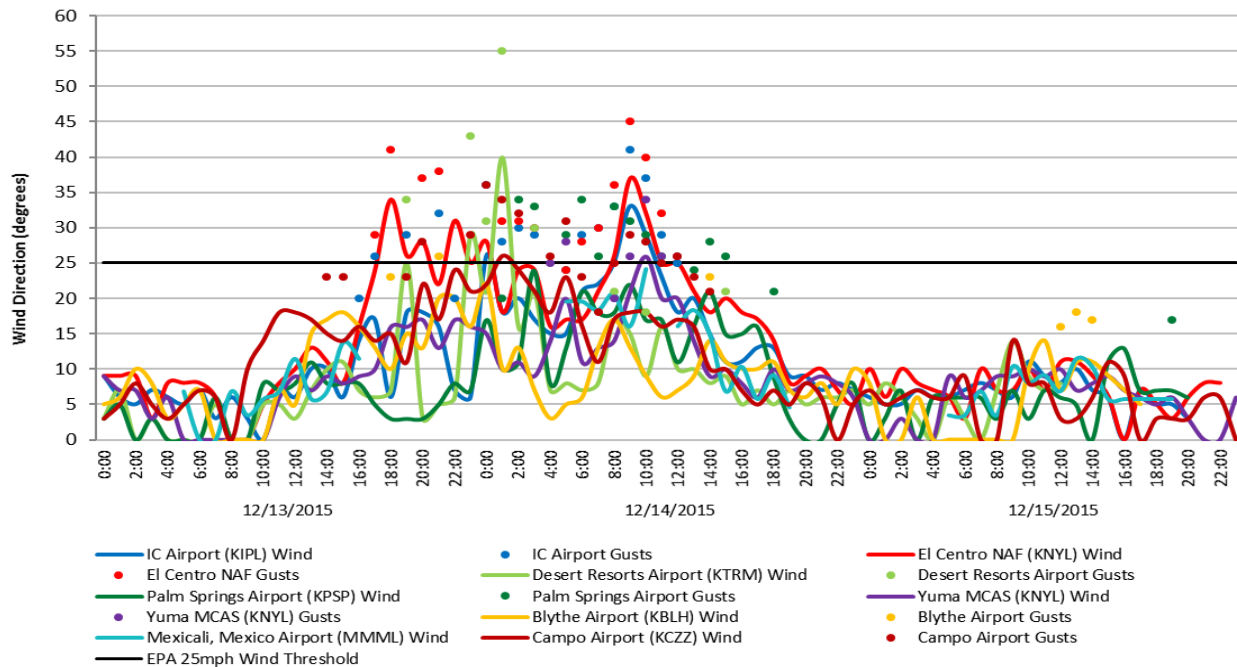


Fig 2-24: Is the graphical representation of the 72-hour measured winds speeds and gusts at various local regional airports. Wind data is from the NCEI’s QCLCD system, except Mexicali Airport which is from the University of Utah’s MesoWest. Due to the various times that different airfields measure wind, the hour given represents the hour in which the measurement was taken, and not necessarily the exact time

⁷ Title 40 Code of Federal Regulations part 50: §50.1(p) High wind dust event is an event that includes the high-speed wind and the dust that the wind entrains and transports to a monitoring site.

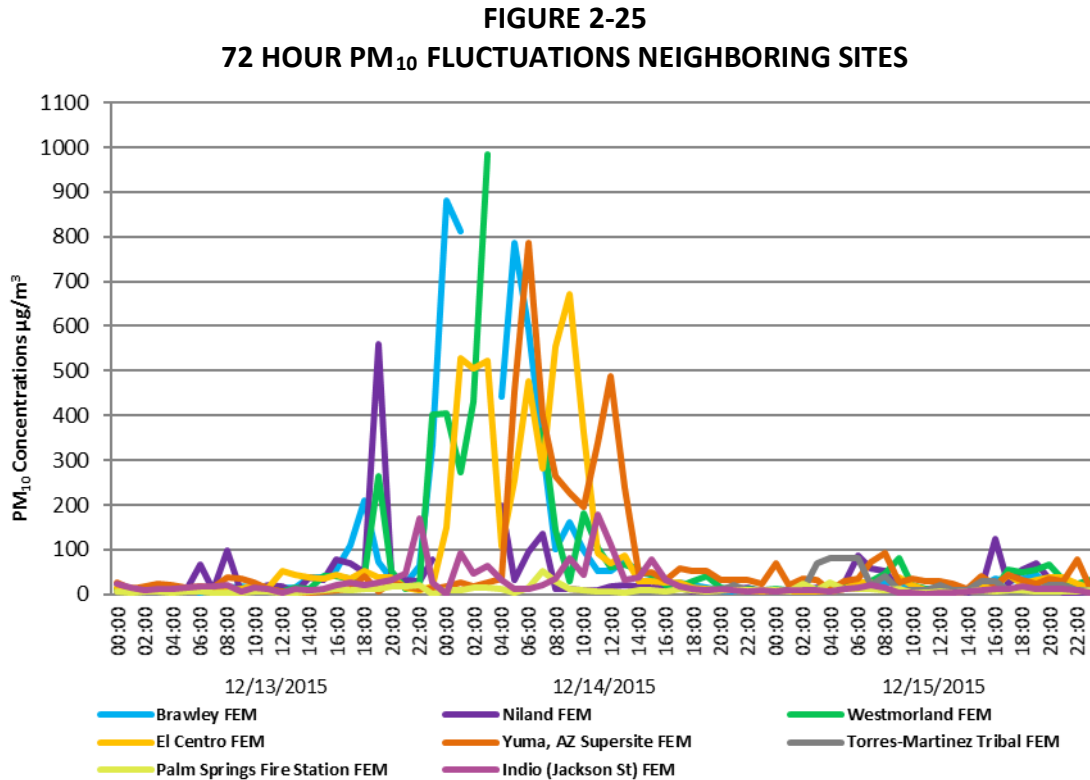


Fig 2-25: The 72-hour PM₁₀ concentrations at monitoring locations throughout Imperial, Riverside and Yuma counties shows that monitors in Imperial County and Yuma, Arizona (MST) were impacted by the windblown dust transported by high winds during the December 14, 2015 event

III Historical Concentrations

III.1 Analysis

While naturally occurring high wind events may recur seasonally and at times frequently and qualify for exclusion under the EER, historical comparisons of the particulate concentrations and associated winds provide insight into the frequency of events within an identified area. The following time series plots illustrate that PM₁₀ concentrations measured at the Brawley, El Centro, Niland, and Westmorland monitors on December 14, 2015, were compared to non-event and event days demonstrating the variability over several years and seasons. The analysis also provides supporting evidence that there exists a clear causal relationship between the December 14, 2015 high wind event and the exceedance measured at the Brawley, El Centro, Niland, and Westmorland monitors.

Figures 3-1 through 3-10 show the time series of available FRM and BAM 24-hr PM₁₀ concentrations at the Brawley, El Centro, Niland, and Westmorland stations for the period of January 1, 2010 through December 14, 2015. Note that prior to 2013, BAM data was not FEM therefore was not reported into AQS.⁸ In order to properly establish the variability of the event as it occurred on December 14, 2015, 24-hour averaged PM₁₀ concentrations between January 1, 2010 and December 14, 2015 were compiled and plotted as a time series. All figures illustrate that the exceedance, which occurred on December 14, 2015, were outside the normal historical concentrations when compared to event and non-event days. Air quality data for all graphs obtained through the EPA's AQS data bank.

⁸ Pollutant concentration data contained in EPA's Air Quality System (AQS) are required to be reported in units corrected to standard temperature and pressure (25 C, 760 mm Hg). Because the PM₁₀ concentrations prior to 2013 were not reported into the AQS database all BAM (FEM) data prior to 2013 within this report are expressed as micrograms per cubic meter (mg/m³) at local temperature and pressure (LTP) as opposed to standard temperature and pressure (STP, 760 torr and 25 C). The difference in concentration measurements between standard conditions and local conditions is insignificant and does not alter or cause any significant changes in conclusions to comparisons of PM₁₀ concentrations to PM₁₀ concentrations with in this demonstration.

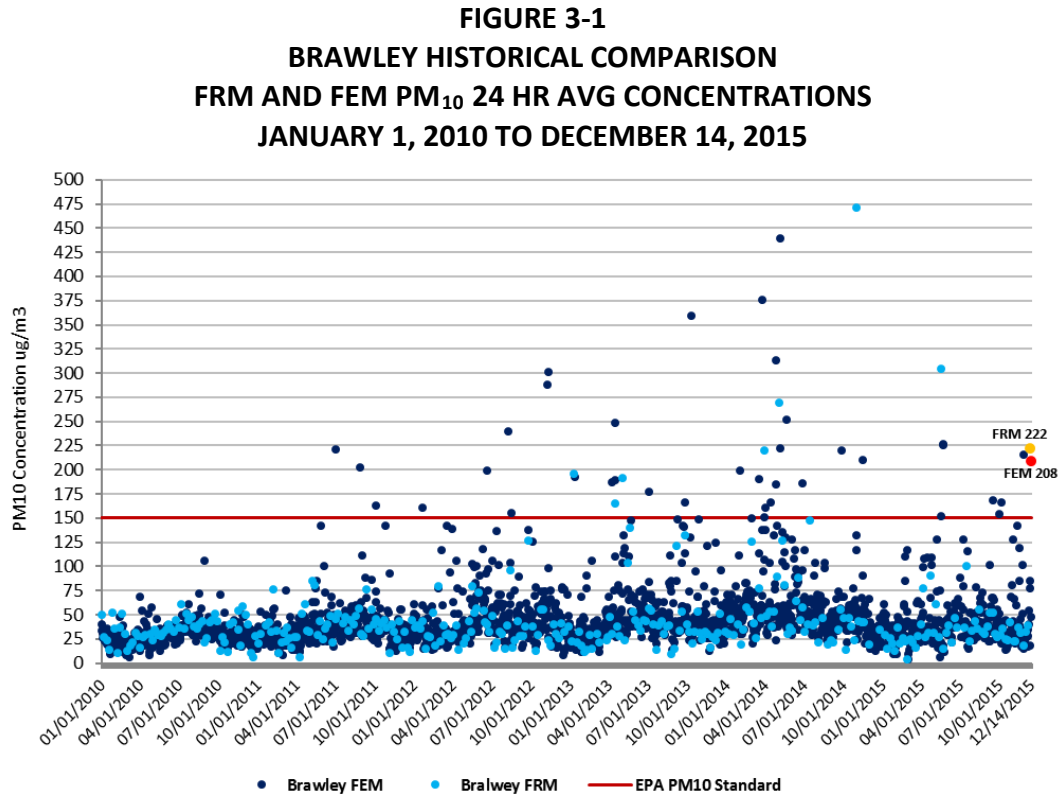


Fig 3-1: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 222 $\mu\text{g}/\text{m}^3$ and 208 $\mu\text{g}/\text{m}^3$ on December 14, 2015 by the Brawley monitor was outside the normal historical concentrations when compared to similar event days and non-event days

FIGURE 3-2
EL CENTRO HISTORICAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
JANUARY 1, 2010 TO DECEMBER 14, 2015

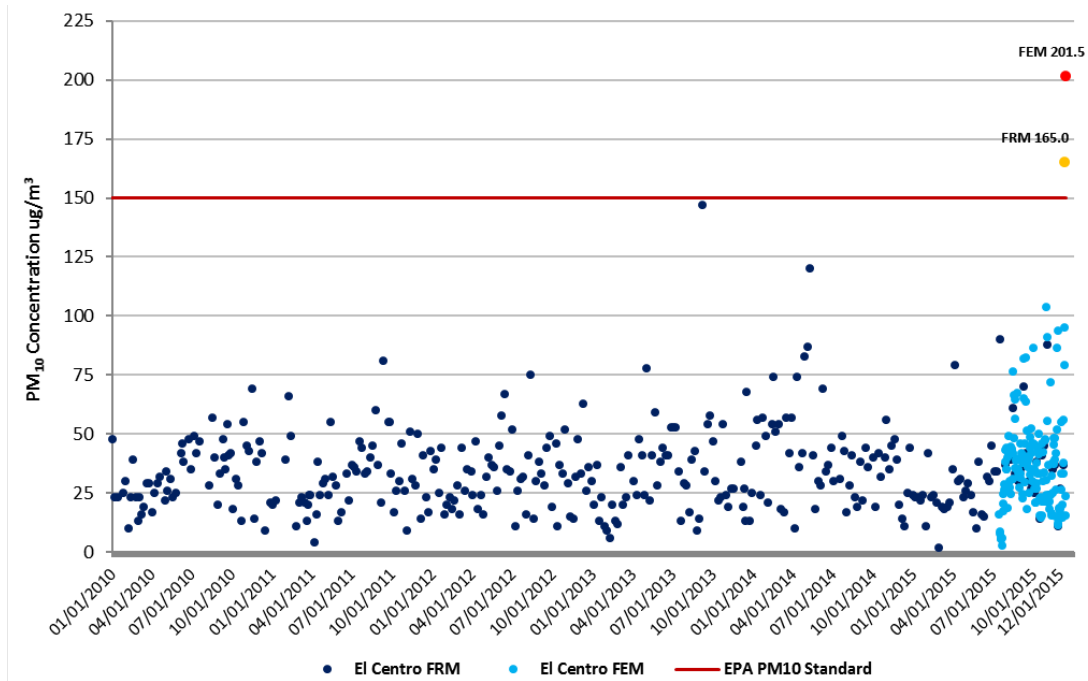


Fig 3-2: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 165 $\mu\text{g}/\text{m}^3$ and 201 $\mu\text{g}/\text{m}^3$ on December 14, 2015 by the El Centro monitor was outside the normal historical concentrations when compared to similar event days and non-event days

FIGURE 3-3
NILAND HISTORICAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
JANUARY 1, 2010 TO DECEMBER 14, 2015

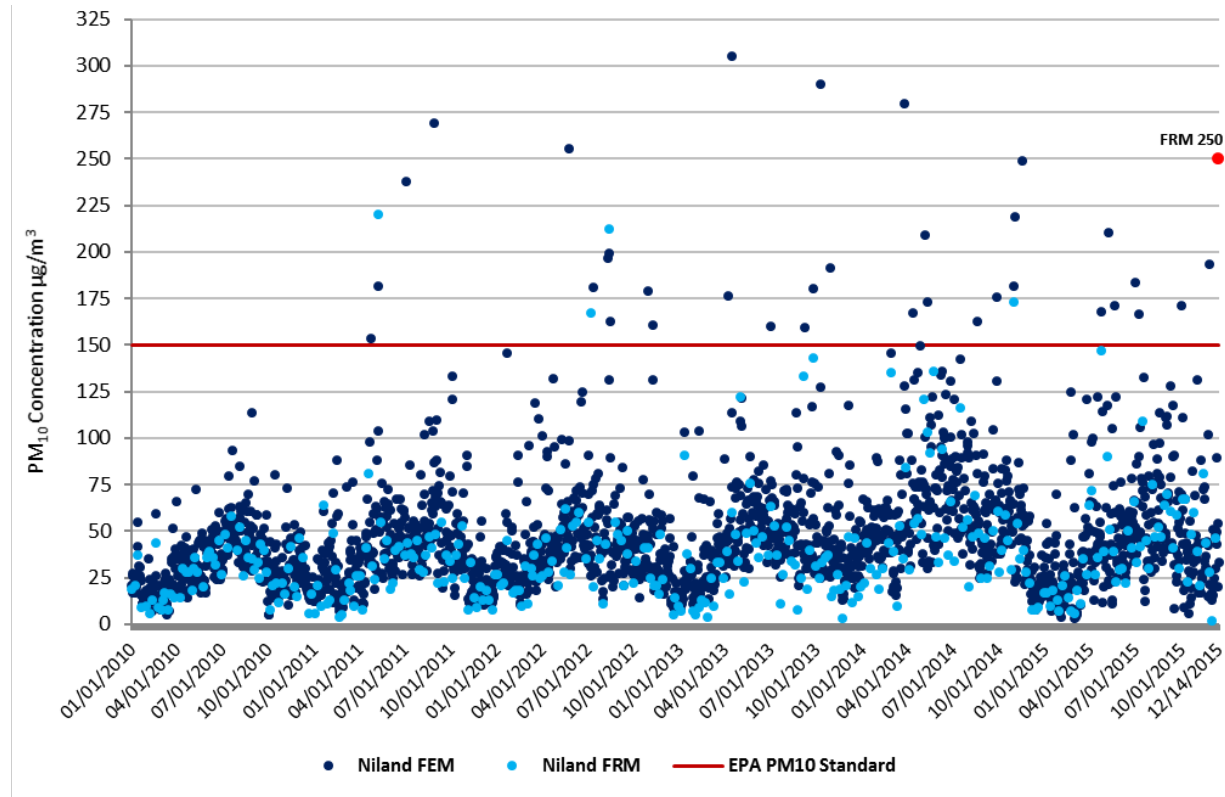


Fig 3-3: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 250 $\mu\text{g}/\text{m}^3$ on December 14, 2015 by the Niland monitor was outside the normal historical concentrations when compared to similar event days and non-event days

FIGURE 3-4
WESTMORLAND HISTORICAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
JANUARY 1, 2010 TO DECEMBER 14, 2015

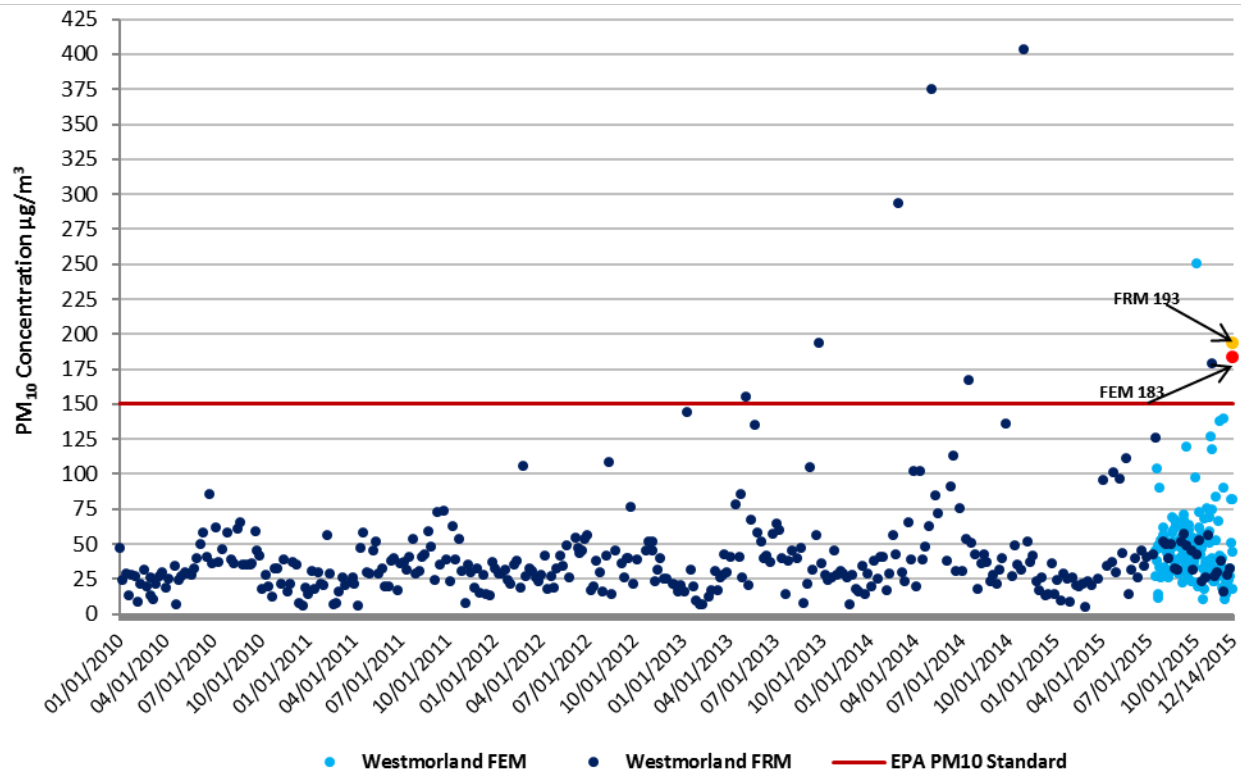


Fig 3-4: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 193 $\mu\text{g}/\text{m}^3$ and 183 $\mu\text{g}/\text{m}^3$ on December 14, 2015 by the Westmorland monitor was outside the normal historical concentrations when compared to similar event days and non-event days

FIGURE 3-5
BRAWLEY, EL CENTRO, WESTMORLAND AND NILAND
HISTORICAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
JANUARY 1, 2010 TO DECEMBER 14, 2015

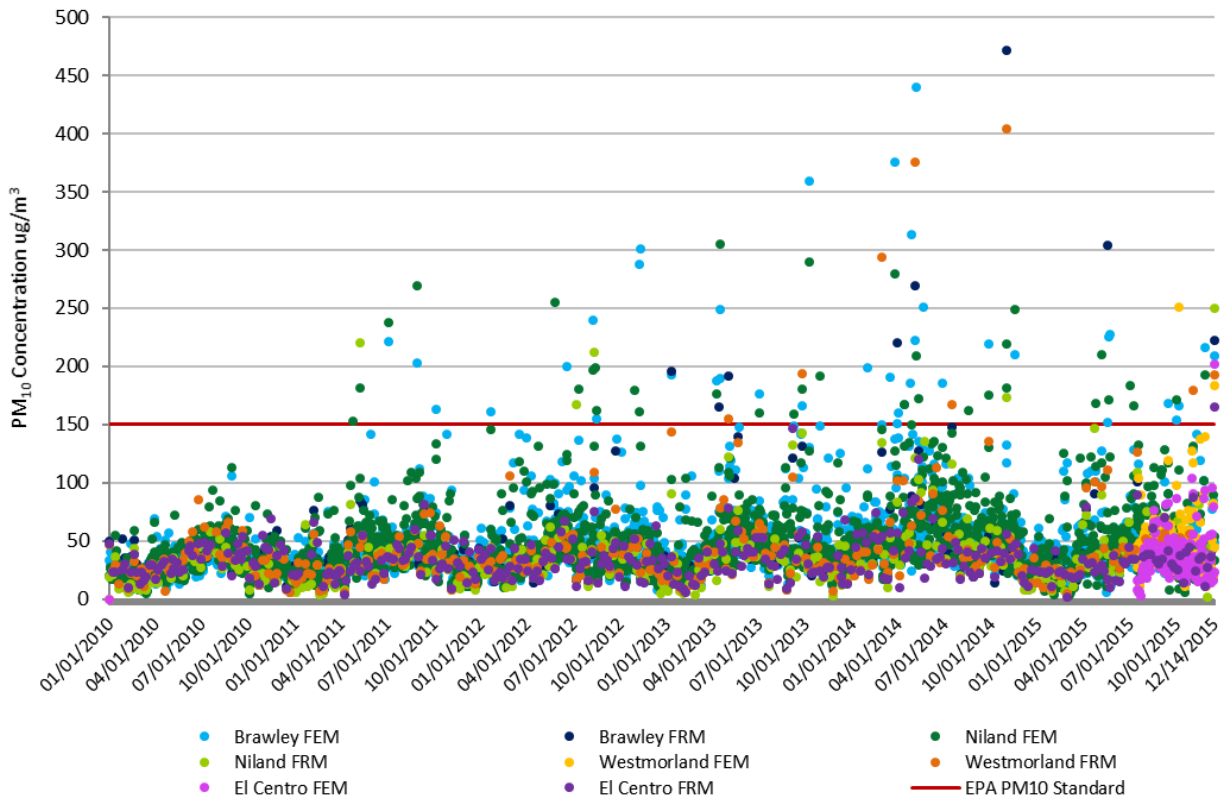


Fig 3-5: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentrations of 222 µg/m³, 165 µg/m³, 250 µg/m³, 193 µg/m³, 208 µg/m³, 183 µg/m³, and 201 µg/m³ on December 14, 2015 by the Brawley, Niland, Westmorland and El Centro monitors were outside the normal historical concentrations when compared to similar event days and non-event days

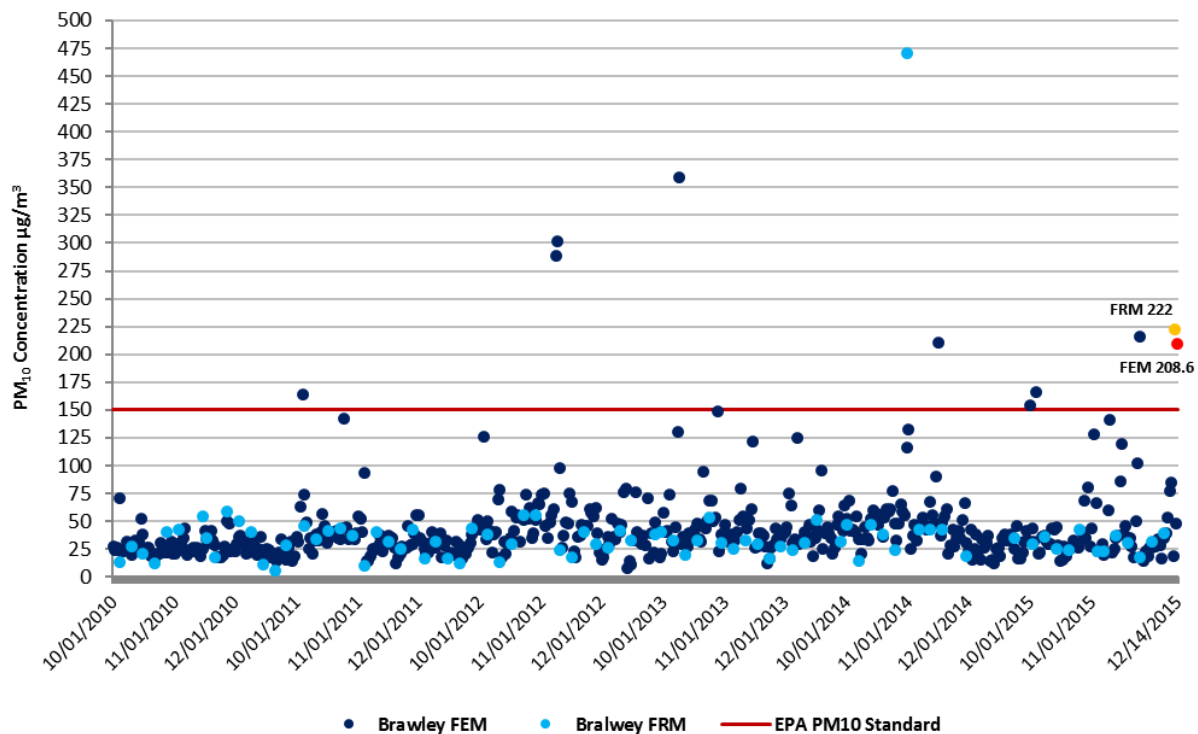
The time series, **Figure 3-5**, for Brawley, El Centro, Westmorland, and Niland includes 6,047 credible samples, measured either FRM or FEM monitors between January 1, 2010 and December 14, 2015.

Overall, the time series illustrates that of the 2,173 sampling days there were a total of 60 exceedance days that occurred during the time of January 1, 2010 through December 14, 2015. Of the total 60 exceedance days eight days experienced singular FRM exceedances with no corresponding FEM exceedances. Two of the singular FRM exceedances occurred during the first quarter, three singular FRM exceedances occurred during the second quarter, two singular FRM exceedances occurred during the third quarter, while one singular exceedance occurred during the fourth quarter. For FEM BAM and/or a combination of FRM/FEM measurements during the

same time period there were 52 measured exceedances. From the 52 FRM/FEM exceedances, 15 measured exceedance days were recorded during the fourth quarter (October through December). No exceedances of the standard occurred during 2010. As mentioned above FEM BAM data was not considered regulatory from 2010 to 2012.

Figures 3-6 through 3-9 display the seasonal fluctuations for Brawley, El Centro, Westmorland, and Niland between October and December for the years 2010 through 2015 (2015 ending December 14). **Figure 3-10** combines the seasonal concentrations of all stations. Of the 1,639 credible samples measured, only 17 exceedance days occurred during the October to December time period between 2010 and 2015.

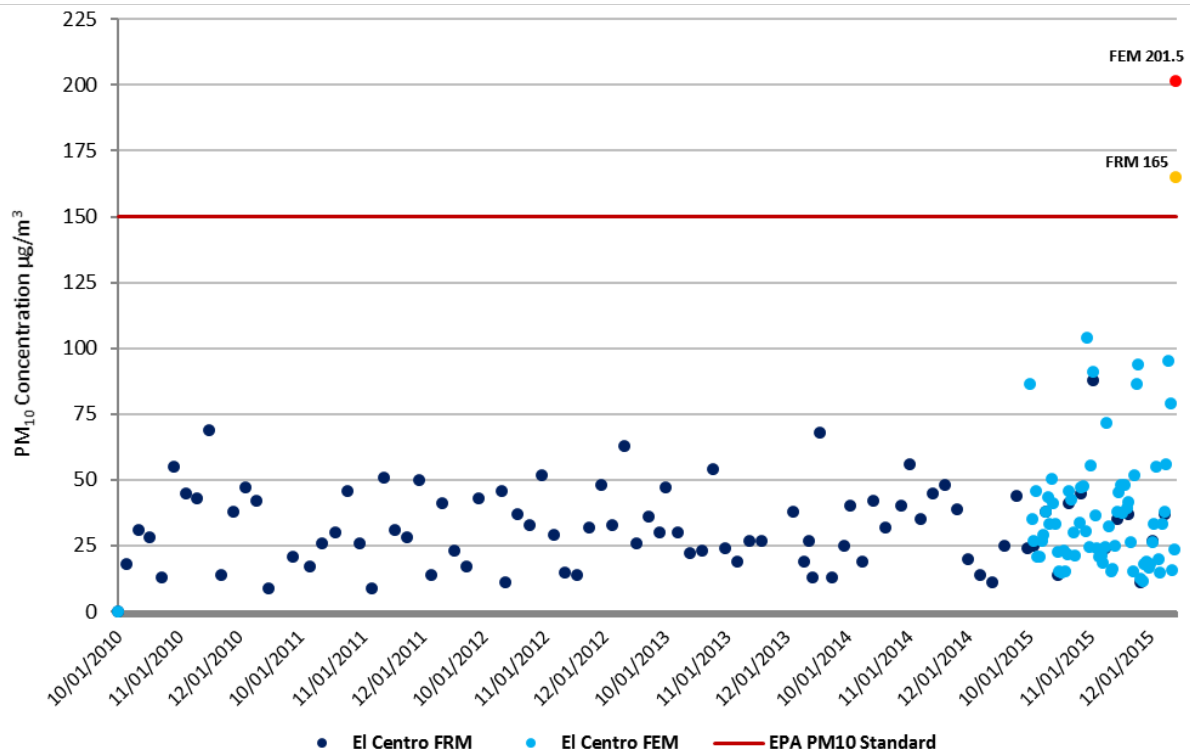
FIGURE 3-6
BRAWLEY SEASONAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
***OCTOBER 1, 2010 THROUGH DECEMBER 14, 2015**



*Quarterly: October 1, 2010 through December 31, 2015 and October 1, 2015 through December 14, 2015

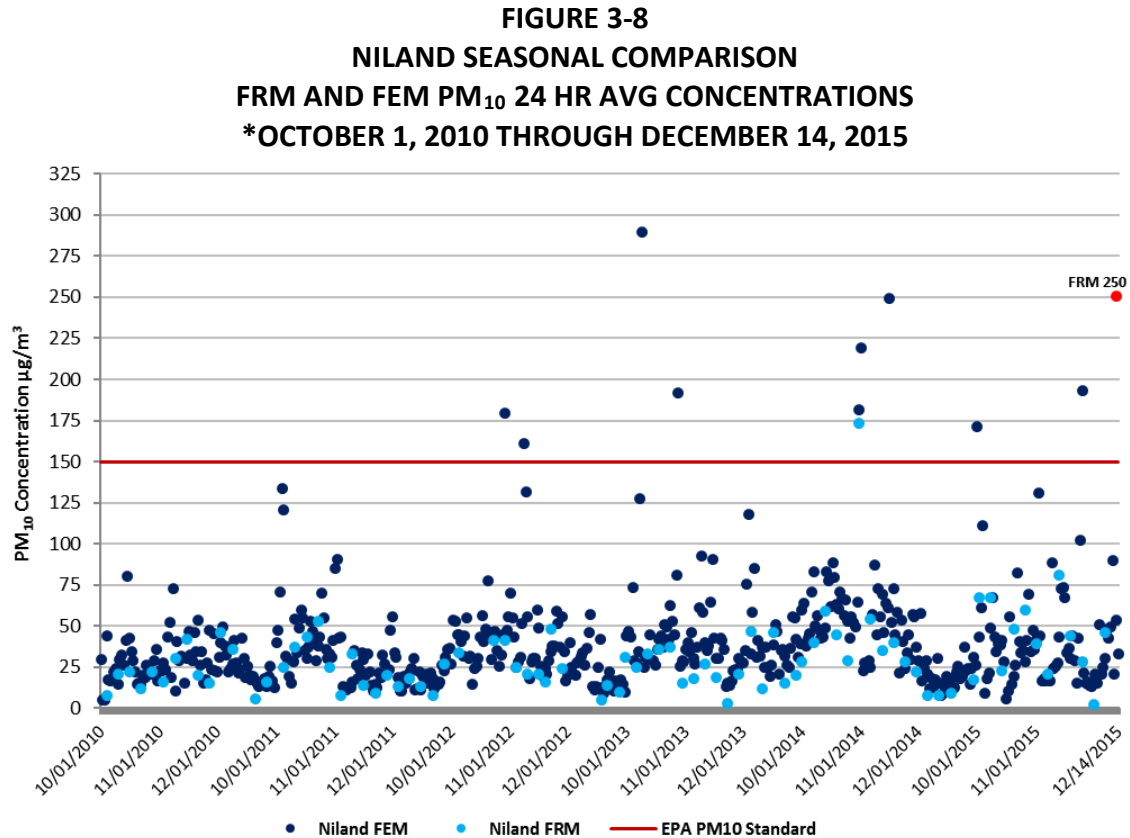
Fig 3-6: A comparison of PM₁₀ seasonal concentrations demonstrates that the measured concentrations of 222 µg/m³ and 208 µg/m³ on December 14, 2015 by the Brawley monitor was outside the normal historical concentrations when compared to similar event days and non-event days

FIGURE 3-7
EL CENTRO SEASONAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
***OCTOBER 1, 2010 THROUGH DECEMBER 14, 2015**



*Quarterly: October 1, 2010 through December 31, 2015 and October 1, 2015 through December 14, 2015

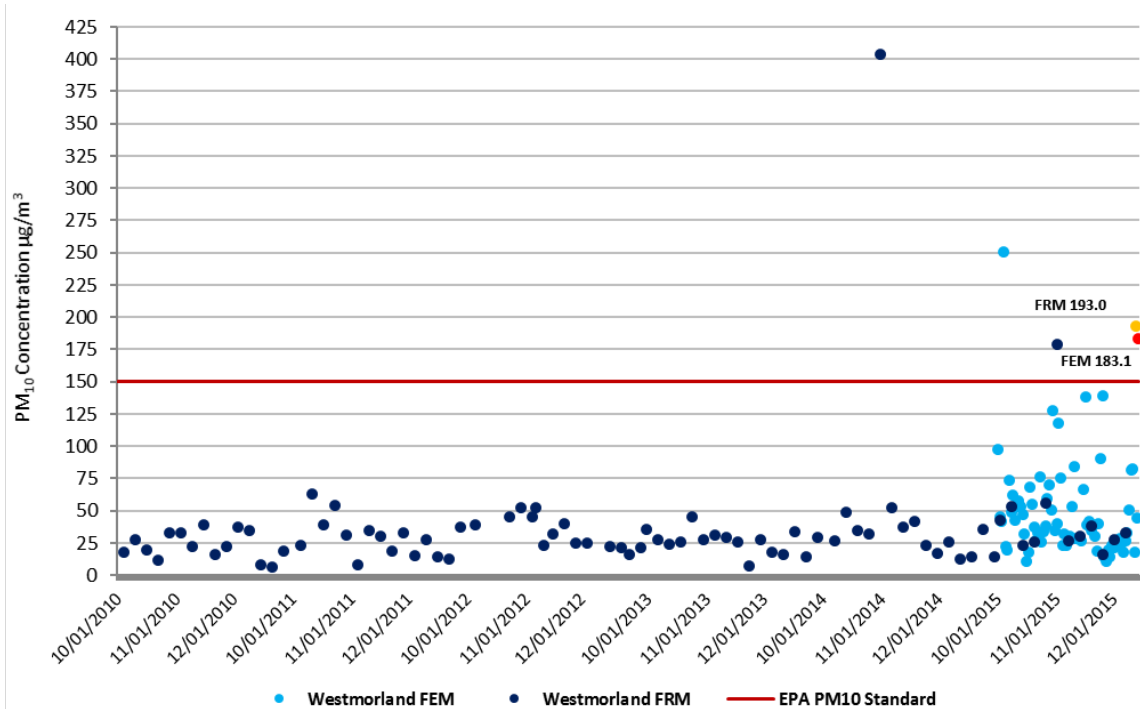
Fig 3-7: A comparison of PM₁₀ seasonal concentrations demonstrates that the measured concentrations of 165 $\mu\text{g}/\text{m}^3$ and 201 $\mu\text{g}/\text{m}^3$ on December 14, 2015 by the El Centro monitor was outside the normal historical concentrations when compared to similar event days and non-event days



*Quarterly: October 1, 2010 through December 31, 2015 and October 1, 2015 through December 14, 2015

Fig 3-8: A comparison of PM₁₀ seasonal concentrations demonstrates that the measured concentrations of 250 $\mu\text{g}/\text{m}^3$ on December 14, 2015 by the Niland monitor was outside the normal historical concentrations when compared to similar event days and non-event days

FIGURE 3-9
WESTMORLAND SEASONAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
***OCTOBER 1, 2010 THROUGH DECEMBER 14, 2015**



*Quarterly: October 1, 2010 through December 31, 2015 and October 1, 2015 through December 14, 2015

Fig 3-9: A comparison of PM₁₀ seasonal concentrations demonstrates that the measured concentrations of 193 $\mu\text{g}/\text{m}^3$ and 183 $\mu\text{g}/\text{m}^3$ on December 14, 2015 by the Westmorland monitor was outside the normal historical concentrations when compared to similar event days and non-event days

FIGURE 3-10
BRAWLEY, EL CENTRO, WESTMORLAND AND NILAND
SEASONAL COMPARISON
FRM AND FEM PM₁₀ 24 HR AVG CONCENTRATIONS
***OCTOBER 1, 2010 THROUGH DECEMBER 14, 2015**

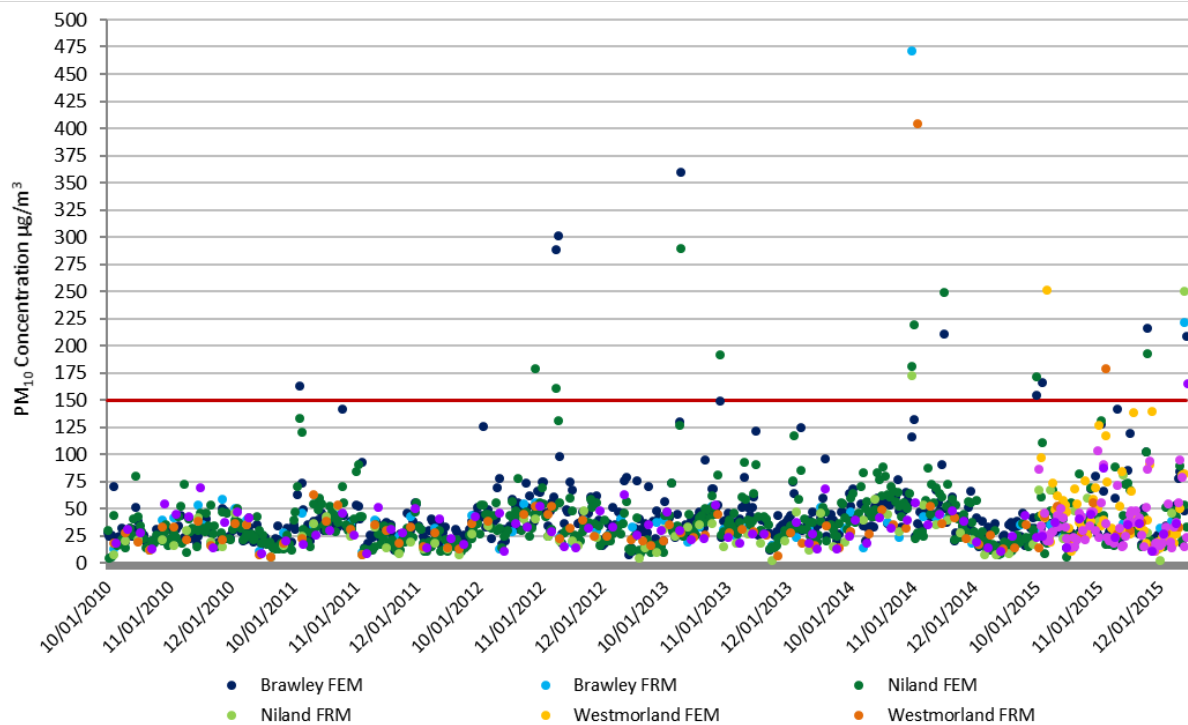


Fig 3-10: A comparison of PM₁₀ seasonal concentrations demonstrates that the measured concentrations of 222 µg/m³ 165 µg/m³ 250 µg/m³ 193 µg/m³ 208 µg/m³ 183 µg/m³ and 201 µg/m³ on December 14, 2015 by the Brawley, Niland, Westmorland and El Centro monitors on December 14, 2015 by the Niland, Brawley, Westmorland and El Centro monitors were outside the normal historical concentrations when compared to similar event days and non-event days

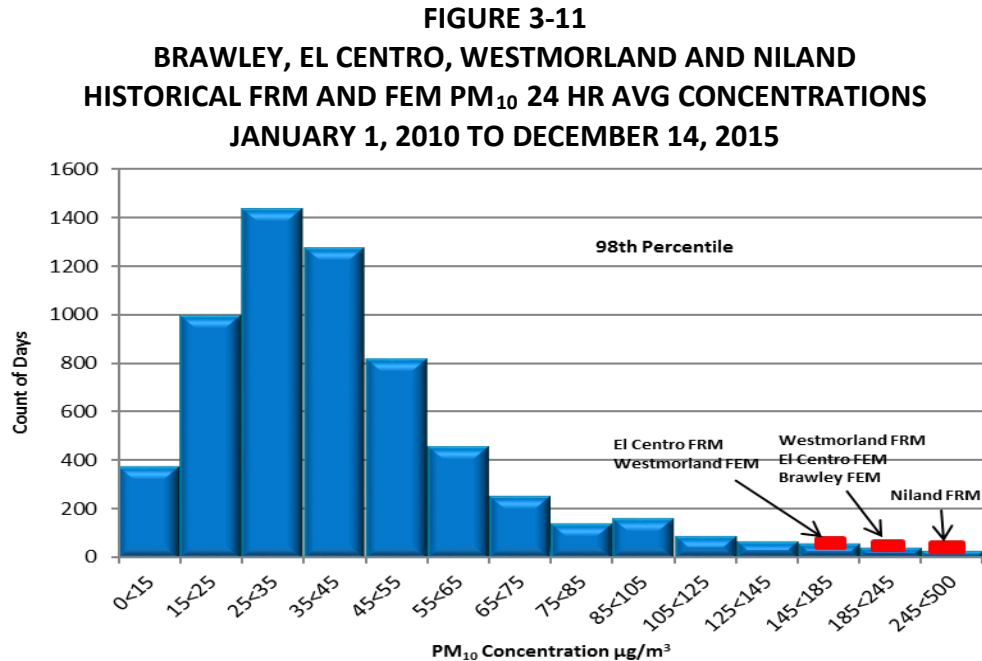
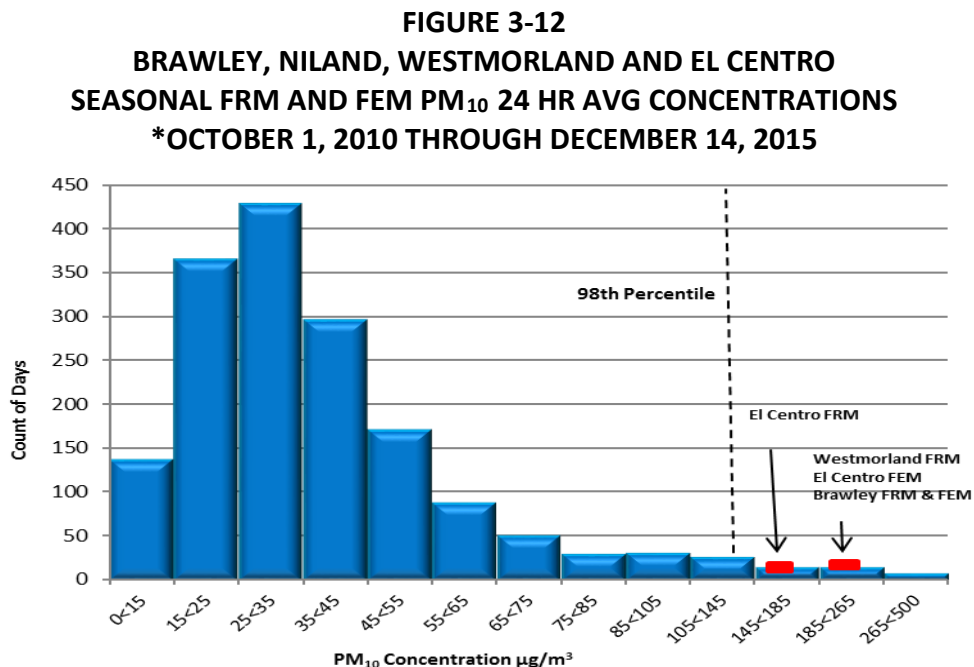


Fig 3-11: The 24-hr average PM₁₀ concentrations measured at Brawley, El Centro, Westmorland, and Niland monitors demonstrate that the December 14, 2015 event was in excess of the 98th percentile



*Quarterly: October 1, 2010 through December 31, 2015 and October 1, 2015 through December 14, 2015

Fig 3-12: The 24-hr average PM₁₀ concentration at the Brawley, El Centro, Westmorland, and Niland monitor demonstrates that the December 14, 2015 event was in excess of the 98th percentile

For the combined FRM and FEM annual 2010 through 2015 Brawley, El Centro, Westmorland, and Niland dataset the concentrations of 222 $\mu\text{g}/\text{m}^3$, 165 $\mu\text{g}/\text{m}^3$, 193 $\mu\text{g}/\text{m}^3$, 250 $\mu\text{g}/\text{m}^3$, 208 $\mu\text{g}/\text{m}^3$, 201 $\mu\text{g}/\text{m}^3$, and 183 $\mu\text{g}/\text{m}^3$ are above the 98th percentile ranking.

For the combined FRM and FEM seasonal historical 2010 to 2015 dataset for Brawley, El Centro, Westmorland, and Niland, the concentrations of 222 $\mu\text{g}/\text{m}^3$, 165 $\mu\text{g}/\text{m}^3$, 193 $\mu\text{g}/\text{m}^3$, 250 $\mu\text{g}/\text{m}^3$, 208 $\mu\text{g}/\text{m}^3$, 201 $\mu\text{g}/\text{m}^3$, and 183 $\mu\text{g}/\text{m}^3$ are above the 98th percentile ranking.

Looking at the annual time series concentrations, the seasonal time series concentrations and the percentile ranking the December 14, 2015 measured exceedances for Brawley, El Centro, Westmorland, and Niland are clearly in excess of normal historical fluctuations with seasonal exceedances of the NAAQS not occurring frequently.

III.2 Summary

The information provided, above, by the time series plots, seasonal time series plots, and the percentile rankings illustrate that the PM_{10} concentration observed on December 14, 2015 occurs infrequently. When comparing the measured PM_{10} levels on December 14, 2015 and following USEPA EER guidance, this demonstration provides supporting evidence that the measured exceedances measured at the Brawley, El Centro, Niland, and Westmorland monitoring sites were outside the normal historical and seasonal historical concentration levels.

The historical concentration analysis provided here supports the determination that the December 14, 2015 natural event affected the concentrations levels at the Brawley, El Centro, Niland, and Westmorland monitors causing an exceedance. The concentration analysis further supports that the natural event affected air quality in such a way that there exists a clear causal relationship between the measured exceedances on December 14, 2015 and the natural event, qualifying the natural event as an Exceptional Event.

IV Not Reasonably Controllable or Preventable

According to the October 3, 2016 promulgated revision to the Exceptional Event (EE) rule under 40 CFR §50.14(b)(8) air agencies must address the “not reasonably controllable or preventable” (nRCP) criterion as two prongs. In order to properly address the nRCP criterion the ICAPCD must not only identify the natural and anthropogenic sources of emissions causing and contributing to the monitored exceedance but must identify the relevant State Implementation Plan (SIP) measures and/or other enforceable control measures in place for the identified sources. An effective analysis of the nRCP must include the implementation status of the control measures in order to properly consider the measures as enforceable. USEPA considers control measures enforceable if approved into the SIP within 5 years of an EE demonstration submittal. The identified control measures must address those specific sources that are identified as causing or contributing to a monitored exceedance.

The final EE rule revision explains that an event is considered not reasonably controllable if reasonable measures to control the impact of the event on air quality were applied at the time of the event. Similarly, an event is considered not reasonably preventable if reasonable measures to prevent the event were applied at the time of the event. However, for “high wind events” when PM₁₀ concentrations are due to dust raised by high winds from desert areas whose sources are controlled with Best Available Control Measures (BACM) then the event is a “natural event” where human activity plays little or no direct causal role and thus is considered not preventable.

This section begins by providing background information on all SIP and other enforceable control measures in force during the EE for December 14, 2015. In addition, this December 14, 2015 demonstration provides technical and non-technical evidence that strong gusty westerly winds blew across the mountains and deserts within southeastern California and into Imperial County suspending particulate matter affecting the Brawley, El Centro, Niland, and Westmorland monitors on December 14, 2015. This section identifies all natural and anthropogenic sources and provides regulatory evidence of the enforceability of the control measures in place during the December 14, 2015 EE.

IV.1 Background

Inhalable particulate matter (PM₁₀) contributes to effects that are harmful to human health and the environment, including premature mortality, aggravation of respiratory and cardiovascular disease, decreased lung function, visibility impairment, and damage to vegetation and ecosystems. Upon enactment of the 1990 Clean Air Act (CAA) amendments, Imperial County was classified as moderate nonattainment for the PM₁₀ NAAQS under CAA sections 107(d)(4)(B) and 188(a). By November 15, 1991, such areas were required to develop and submit State Implementation Plan (SIP) revisions providing for, among other things, implementation of reasonably available control measures (RACM).

Partly to address the RACM requirement, ICAPCD adopted local Regulation VIII rules to control PM₁₀ from sources of fugitive dust on October 10, 1994, and revised them on November 25,

1996. USEPA did not act on these versions of the rules with respect to the federally enforceable SIP.

On August 11, 2004, USEPA reclassified Imperial County as a serious nonattainment area for PM₁₀. As a result, CAA section 189(b)(1)(B) required all BACM to be implemented in the area within four years of the effective date of the reclassification, i.e., by September 10, 2008.

On November 8, 2005, partly to address the BACM requirement, ICAPCD revised the Regulation VIII rules to strengthen fugitive dust requirements. On July 8, 2010, USEPA finalized a limited approval of the 2005 version of Regulation VIII, finding that the seven Regulation VIII rules largely fulfilled the relevant CAA requirements. Simultaneously, USEPA also finalized a limited disapproval of several of the rules, identifying specific deficiencies that needed to be addressed to fully demonstrate compliance with CAA requirements regarding BACM and enforceability.

In September 2010, ICAPCD and the California Department of Parks and Recreation (DPR) filed petitions with the Ninth Circuit Federal Court of Appeals for review of USEPA's limited disapproval of the rules. After hearing oral argument on February 15, 2012, the Ninth Circuit directed the parties to consider mediation before rendering a decision on the litigation. On July 27, 2012, ICAPCD, DPR and USEPA reached agreement on a resolution to the dispute which included a set of specific revisions to Regulation VIII. These revisions are reflected in the version of Regulation VIII adopted by ICAPCD on October 16, 2012 and approved by USEPA April 22, 2013. Since 2006 ICAPCD had implemented regulatory measures to control emissions from fugitive dust sources and open burning in Imperial County.

**FIGURE 4-1
REGULATION VIII GRAPHIC TIMELINE DEVELOPMENT**

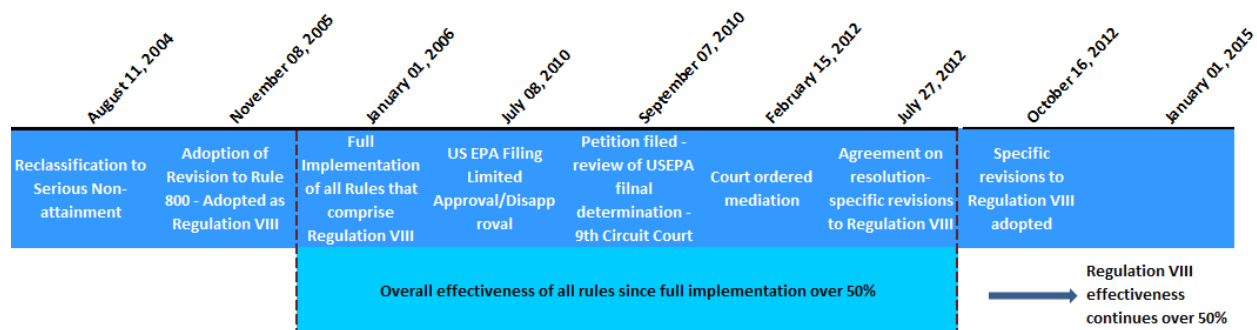


Fig 4-1: Regulation VIII Graphic Timeline

IV.1.a Control Measures

Below is a brief summary of Regulation VIII, which is comprised of seven fugitive dust rules. **Appendix D** contains a complete set of the Regulation VIII rules

ICAPCD's Regulation VIII consists of seven interrelated rules designed to limit emissions of PM₁₀

from anthropogenic fugitive dust sources in Imperial County.

Rule 800, General Requirements for Control of Fine Particulate Matter, provides definitions, a compliance schedule, exemptions and other requirements generally applicable to all seven rules. It requires the United States Bureau of Land Management (BLM), United States Border Patrol (BP) and DPR to submit dust control plans (DCP) to mitigate fugitive dust from areas and/or activities under their control. Appendices A and B within Rule 800 describe methods for determining compliance with opacity and surface stabilization requirements in Rules 801 through 806.

Rule 801, Construction and Earthmoving Activities, establishes a 20% opacity limit and control requirements for construction and earthmoving activities. Affected sources must submit a DCP and comply with other portions of Regulation VIII regarding bulk materials, carry-out and track-out, and paved and unpaved roads. The rule exempts single family homes and waives the 20% opacity limit in winds over 25 mph under certain conditions.

Rule 802, Bulk Materials, establishes a 20% opacity limit and other requirements to control dust from bulk material handling, storage, transport and hauling.

Rule 803, Carry-Out and Track-Out, establishes requirements to prevent and clean-up mud and dirt transported onto paved roads from unpaved roads and areas.

Rule 804, Open Areas, establishes a 20% opacity limit and requires land owners to prevent vehicular trespass and stabilize disturbed soil on open areas larger than 0.5 acres in urban areas, and larger than three acres in rural areas. Agricultural operations are exempted.

Rule 805, Paved and Unpaved Roads, establishes a 20% opacity limit and control requirements for unpaved haul and access roads, canal roads and traffic areas that meet certain size or traffic thresholds. It also prohibits construction of new unpaved roads in certain circumstances. Single-family residences and agricultural operations are exempted.

Rule 806, Conservation Management Practices, requires agricultural operation sites greater than 40 acres to implement at least one conservation management practice (CMP) for each of several activities that often generates dust at agricultural operations. In addition, agricultural operation sites must prepare a CMP plan describing how they comply with Rule 806, and must make the CMP plan available to the ICAPCD upon request.

IV.1.b Additional Measures

Imperial County Natural Events Action Plan (NEAP)

On August 2005, the ICAPCD adopted a NEAP for the Imperial County, as was required under the former USEPA Natural Events Policy, to address PM₁₀ events by:

- Protecting public health;

- Educating the public about high wind events;
- Mitigating health impacts on the community during future events; and
- Identifying and implementing BACM measures for anthropogenic sources of windblown dust.

Smoke Management Plan (SMP) Summary

There are 35 Air Pollution Control Districts or Air Quality Management Districts in California which are required to implement a district-wide smoke management program. The regulatory basis for California's Smoke Management Program, codified under Title 17 of the California Code of Regulations is the "Smoke Management Guidelines for Agricultural and Prescribed Burning" (Guidelines). California's 1987 Guidelines revised to improve interagency coordination, avoid smoke episodes, and provide continued public safety while providing adequate opportunity for necessary open burning. The revisions to the 1987 Guidelines approved March 14, 2001. All air districts, with the exception of the San Joaquin Valley Air Pollution Control District (SJAPCD) were required to update their existing rules and Smoke Management Plans to conform to the most recent update to the Guidelines.

Section 80150 of Title 17 specifies the special requirements for open burning in agricultural operations, the growing of crops and the raising of fowl or animals. This section specifically requires the ICAPCD to have rules and regulations that require permits that contain requirements that minimize smoke impacts from agricultural burning.

On a daily basis, the ICAPCD reviews surface meteorological reports from various airport agencies, the NWS, State fire agencies and CARB to help determine whether the day is a burn day. Using a four-quadrant map of Imperial County allowed burns are allocated in such a manner as to assure minimal to no smoke impacts safeguarding the public health. Finally, all permit holders are required to notice and advise members of the public of a potential burn. This noticing requirement is the Good Neighbor Policy. On December 14, 2015 the ICAPCD declared a No Burn day (**Appendix A**). There were no complaints filed for agricultural burning on December 14, 2015.

IV.1.c Review of Source Permitted Inspections and Public Complaints

A query of the ICAPCD permit database was compiled and reviewed for active permitted sources throughout Imperial County and specifically around Westmorland, Niland, and Brawley during the January 31, 2016 PM₁₀ exceedance. Both permitted and non-permitted sources are required to comply with Regulation VIII requirements that address fugitive dust emissions. The identified permitted sources are Aggregate Products, Inc., US Gypsum Quarry, Imperial Aggregates (Val-Rock, Inc., and Granite Construction), US Gypsum Plaster City, Clean Harbors (Laidlaw Environmental Services), Bullfrog Farms (Dairy), Burrtec Waste Industries, Border Patrol Inspection station, Centinela State Prison, various communications towers not listed and various agricultural operations. Non-permitted sources include the wind farm known as Ocotillo Express, and a solar facility known as CSolar IV West. Finally, the desert regions are under the jurisdiction

of the Bureau of Land Management and the California Department of Parks (Including Anza Borrego State Park and Ocotillo Wells).

An evaluation of all inspection reports, air quality complaints, compliance reports, and other documentation indicate no evidence of unusual anthropogenic-based PM₁₀ emissions. There were no complaints filed on December 14, 2015 officially declared as a No Burn day, related to agricultural burning, waste burning or dust.

FIGURE 4-2
PERMITTED SOURCES

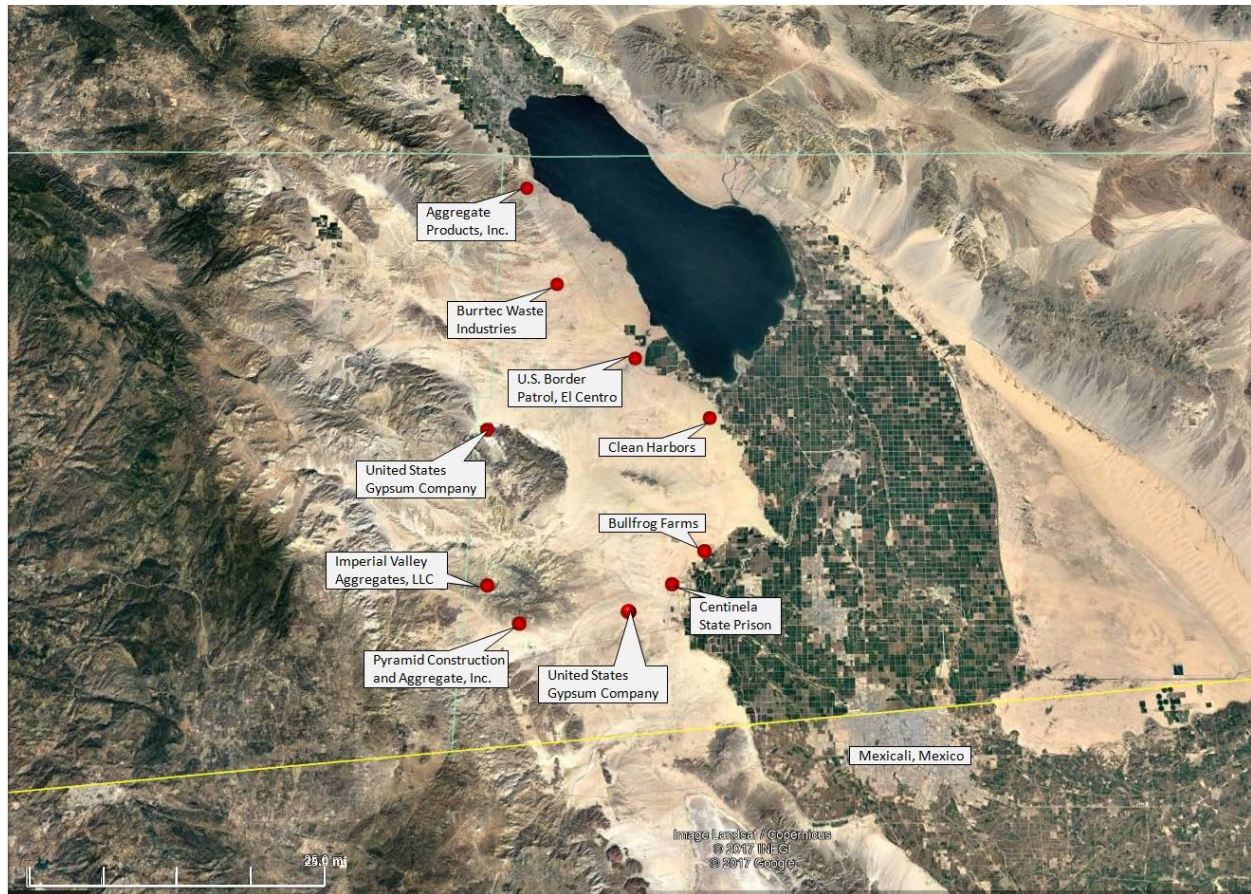


Fig 4-2: The above map identifies those permitted sources located west, northwest and southwest of the Imperial County air monitoring network. The green line to the north denotes the political division between Imperial and Riverside counties. The yellow line below denotes the international border between the United States and Mexico. The green checker-boarded areas are a mixed use of agricultural and community parcels. In addition, either the Bureau of Land Management or the California Department of Parks manages the desert areas. Base map from Google Earth

FIGURE 4-3
NON-PERMITTED SOURCES

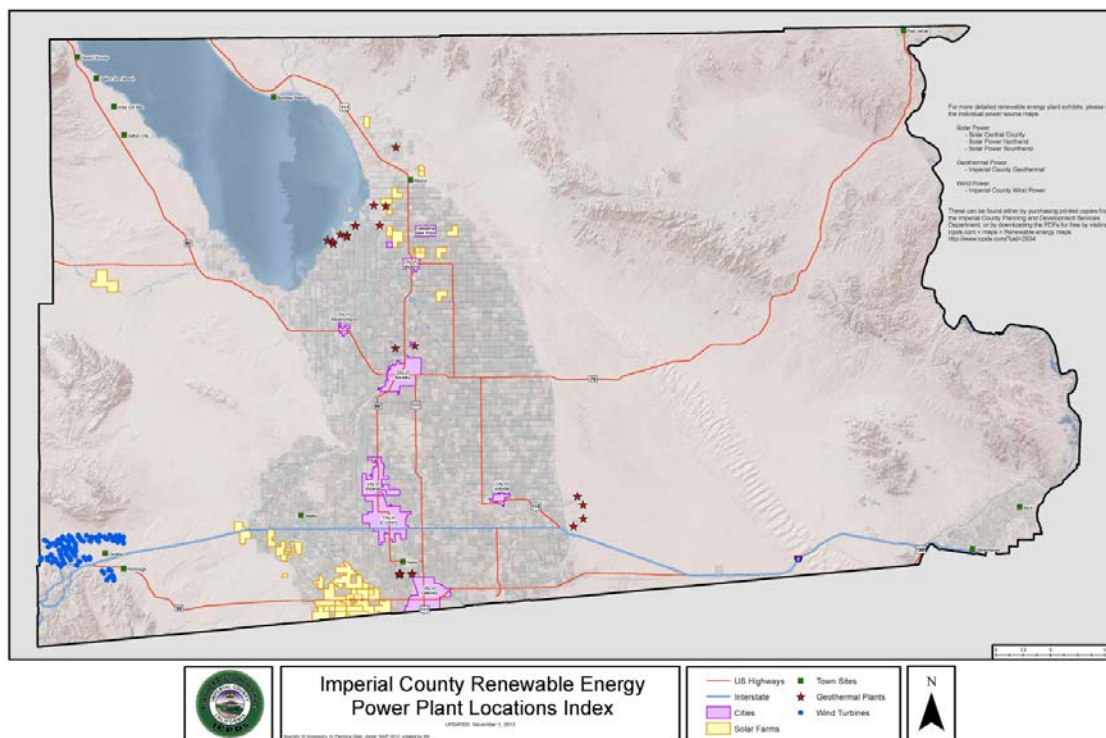


Fig 4-3: The above map identifies those power sources located west, northwest and southwest of the Imperial County air monitoring network. Blue indicate the Wind Turbines, Yellow are the solar farms and stars are geothermal plants

IV.2 Forecasts and Warnings

The ICAPCD published the National Weather Service (NWS) San Diego and Phoenix offices synopsis for the weekend covering December 11, 2015 through December 14, 2015. The published notification advised the public that a Pacific cold front would be moving through Southern California with strong west winds, rain and snow showers, and colder conditions. The notification indicated that the strongest winds would be along the ridges of the San Diego and Riverside County Mountains.

The San Diego and Phoenix NWS offices issued weather briefings, Urgent Weather Messages and Special Weather Statements for Sand Diego County, including the mountains and deserts and Imperial County. Because the low-pressure trough that passed through the region December 13, 2015 through December 14, 2015 was one of two weather systems, the San Diego NWS office issued Urgent Weather Messages, containing wind advisories, as early as December 12, 2015. By the evening hours of December 12, 2015 winds had calmed however the Area Forecast issued by the San Diego NWS office identified a second winter-like storm system developing out of the Pacific northwest for Sunday December 13, 2015 which would move through Southern California Sunday evening through Monday morning.

By December 13, 2015 the expected cold front was well defined and was expected to create fairly strong and gusty westerly winds within the San Diego mountain slopes and deserts. The first Urgent Weather Message, issued by the San Diego NWS office at 1:41 PST identified southwest to west winds 20 to 30 mph with gusts to 45 mph with hazardous travel warning along Interstate 10 and Interstate 8. In total, the San Diego NWS office issued five Urgent Weather messages through December 14, 2015. The release of preliminary and final Public Statements confirmed strong winds along and within the mountain passes and desert slopes ranging between 40 mph and 59 mph. The NWS office in Phoenix issued on December 14, 2015 a single Special Weather Statement indicating a deep and cold low-pressure system bringing widespread cold temperatures.

A web-based Air Quality Forecast / Air Quality Alert was issued by the ICAPCD at 9:19 a.m. on December 14, 2015. The forecast stated that gusty northwesterly winds would result in blowing dust. Air quality⁹ alerts were issued by the ICAPCD for the Brawley area on December 14, 2015. The first alert was issued at 3 a.m. and notified the public that air quality had entered the “Orange” or “Unhealthy for Sensitive Groups” range that meant PM₁₀ levels had reached 101-150 µg/m³. At 7 a.m. another air quality alert was issued advising the public that air quality had entered the “Red” or “Unhealthy” category with PM₁₀ levels of 151 to 200 µg/m³. **Appendix A** contains copies of all pertinent notices for the December 14, 2015 event.

IV.3 Wind Observations

Wind data during the event were available from airports in eastern Riverside County, southern San Diego County, southwestern Yuma County (Arizona), northern Mexico, and Imperial County. Imperial County Airport (KIPL) recorded four hours of winds at or above the 25 mph threshold with six hours of gusts at or above 30 mph. Peak winds at the airport were 33 mph and the peak gust was 41 mph. The El Centro NAF measured winds of up to 37 mph as well as measuring gusty winds of up to 45 mph. The airfield recorded six hours of winds at or above 25 mph, with seven hours of gusts at or above 30 mph (see **Table 2-2**). Wind speeds of over 25 mph are normally sufficient to overcome most PM₁₀ control measures. During the December 14, 2015 event wind speeds were above the 25 mph threshold overcoming the BACM in place.

IV.4 Summary

The weather and air quality forecasts and warnings outlined in this section demonstrate that high winds accompanying a strong cold front that moved through southern California entrained particulate matter that caused uncontrollable PM₁₀ emissions. The BACM list as part of the

⁹ The AQI is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects you may experience within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health. Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in this country. Source: <https://airnow.gov/index.cfm?action=aqibasics.aqi>.

control measures in Imperial County for fugitive dust emissions were in place at the time of the event. These control measures are required for areas designated as "serious" non-attainment for PM₁₀, such as Imperial County. Thus, the BACM in place at the time of the event were beyond reasonable. In addition, surface wind measurements west of the Brawley, El Centro, Niland, and Westmorland monitoring stations during the event were high enough (at or above 25 mph, with wind gusts of 45 mph) that BACM PM₁₀ control measures would have been overwhelmed.

Finally, a high wind dust event can be considered as a natural event, even when portions of the wind-driven emissions are anthropogenic, as long as those emissions have a clear causal relationship to the event and were determined to be not reasonably controllable or preventable. This demonstration has shown that the event that occurred on December 14, 2015 was not reasonably controllable or preventable despite the strong and in force BACM within the affected areas in Imperial County. This demonstration has similarly established a clear causal relationship between the exceedances and the high wind event timeline and geographic location. The December 14, 2015 event can be considered an exceptional event under the requirements of the exceptional event rule.

V Clear Causal Relationship

IV.1 Discussion

Meteorological observations for December 14, 2015 identified a cold front with strong surface winds moved rapidly past Point Conception later Sunday December 13, 2015 reaching the San Diego mountain passes and deserts that evening. Following the well-defined front was a low-pressure trough that caused the tightening of the pressure gradients causing fairly strong gusty westerly winds within the mountain and desert slopes within San Diego County and Imperial County during the morning hours of December 14, 2015. Final Public Information Statements released by the San Diego NWS office confirmed excess wind speeds and gusts on Monday, December 14, 2015 in areas such as Boulevard, Borrego Springs, Ocotillo Wells and areas along Interstate 8 measuring between 40mph and 59 mph. Locally, both the Imperial County Airport (KIPL) and El Centro NAF (KNJK) measured consecutive hours of winds at or above the 25-mph threshold.

Entrained windblown dust from natural areas, particularly from the desert areas west of the Brawley, Westmorland, El Centro and Niland monitors, along with anthropogenic sources controlled with BACM, is confirmed by the meteorological and air quality observations on December 14, 2015.

Figures 5-1 and 5-2 are Terra and Aqua MODIS satellite images that show the transport of dust particles across Imperial County by the high winds.

FIGURE 5-1
MODIS TERRA SATELLITE IMAGE DECEMBER 14, 2015

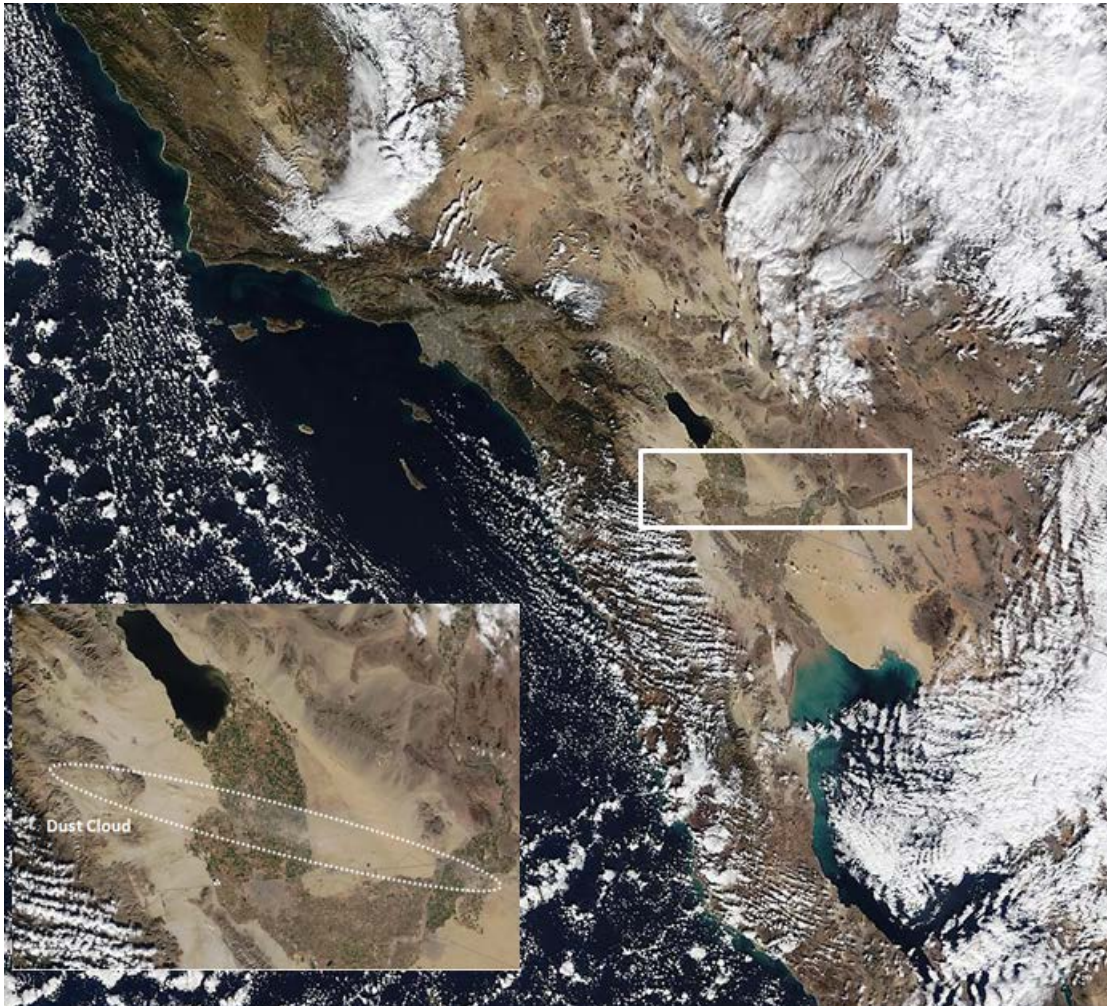


Fig 5-1: A MODIS Terra satellite image (~1030 PST) captured a dust plume over Imperial County created by the strong, gusty winds on December 14, 2015. Although this was following the most significant hourly concentrations on December 14, 2015, it helps illustrate the distance traveled by dust plumes. Source: MODIS Today

FIGURE 5-2
MODIS AQUA SATELLITE IMAGE DECEMBER 14, 2015

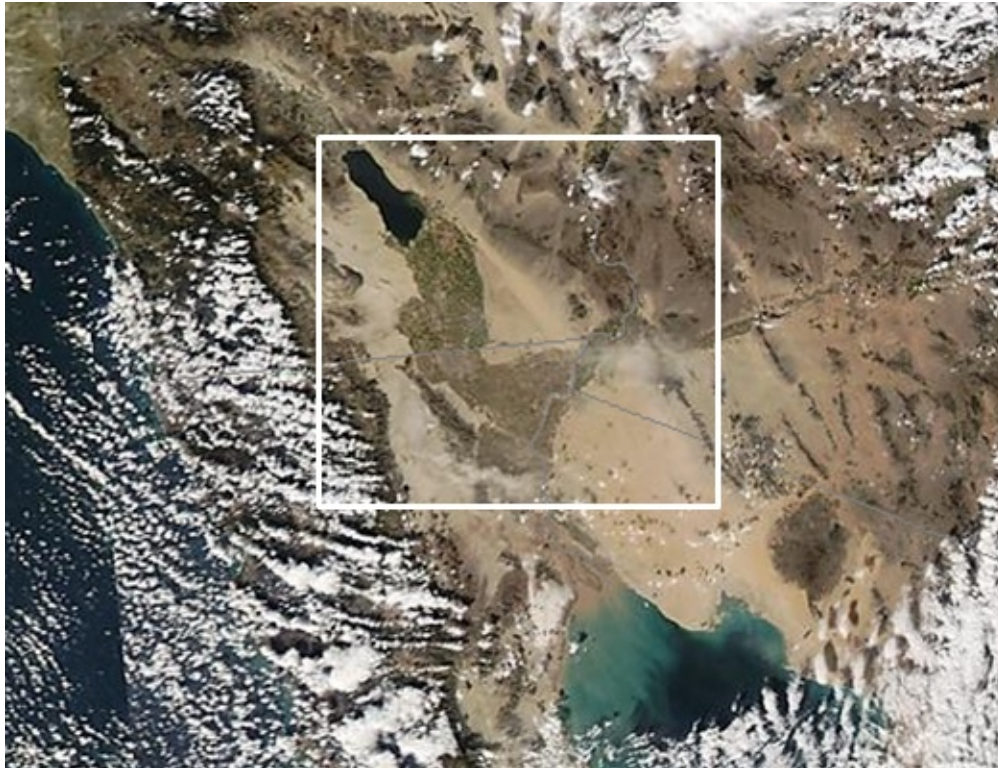


Fig 5-2: A MODIS Aqua satellite image (~1330 PST) captured a dust plume over Imperial County created by the strong, gusty winds on December 14, 2015. Although this was following the most significant hourly concentrations on December 14, 2015, it helps to illustrate the distance travelled by dust plumes. Source: MODIS Today

Figures 5-3 through 5-5 are Aerosol Optical Depth (AOD)¹⁰ images using the Deep Blue layer¹¹ that were captured by the MODIS instrument onboard the Terra and Aqua satellites. **Figure 5-4** utilizes the Deep Blue Angstrom Exponent layer¹² to further discriminate between aerosol particle size.

¹⁰ Aerosol Optical Depth (AOD) (or Aerosol Optical Thickness) indicates the level at which particles in the air (aerosols) prevent light from traveling through the atmosphere. Aerosols scatter and absorb incoming sunlight, which reduces visibility. From an observer on the ground, an AOD of less than 0.1 is “clean” - characteristic of clear blue sky, bright sun and maximum visibility. As AOD increases to 0.5, 1.0, and greater than 3.0, aerosols become so dense that sun is obscured. Sources of aerosols include pollution from factories, smoke from fires, dust from dust storms, sea salt, and volcanic ash and smog. Aerosols compromise human health when inhaled by people, particularly those with asthma or other respiratory illnesses. Source: <https://worldview.earthdata.nasa.gov>.

¹¹ The Deep Blue Aerosol Optical Depth layer is useful for studying aerosol optical depth over land surfaces. This layer is created from the Deep Blue (DB) algorithm, originally developed for retrieving over desert/arid land (bright in the visible wavelengths) where Dark Target approaches fail.

¹² The MODIS Deep Blue Aerosol Ångström Exponent layer can be used to provide additional information on the aerosol particle size over ocean. This layer is created from the Dark Target (DT) algorithm that retrieves over ocean (dark in visible and longer wavelengths). The Ångström exponent provides additional information on the particle size (larger the exponent, the smaller the particle size). Values < 1 suggest optical dominance of coarse particles (e.g. dust) and values > 1 suggest optical dominance of fine particles (e.g. smoke).

FIGURE 5-3
HEAVY AEROSOLS OVER SOUTHEAST CALIFORNIA

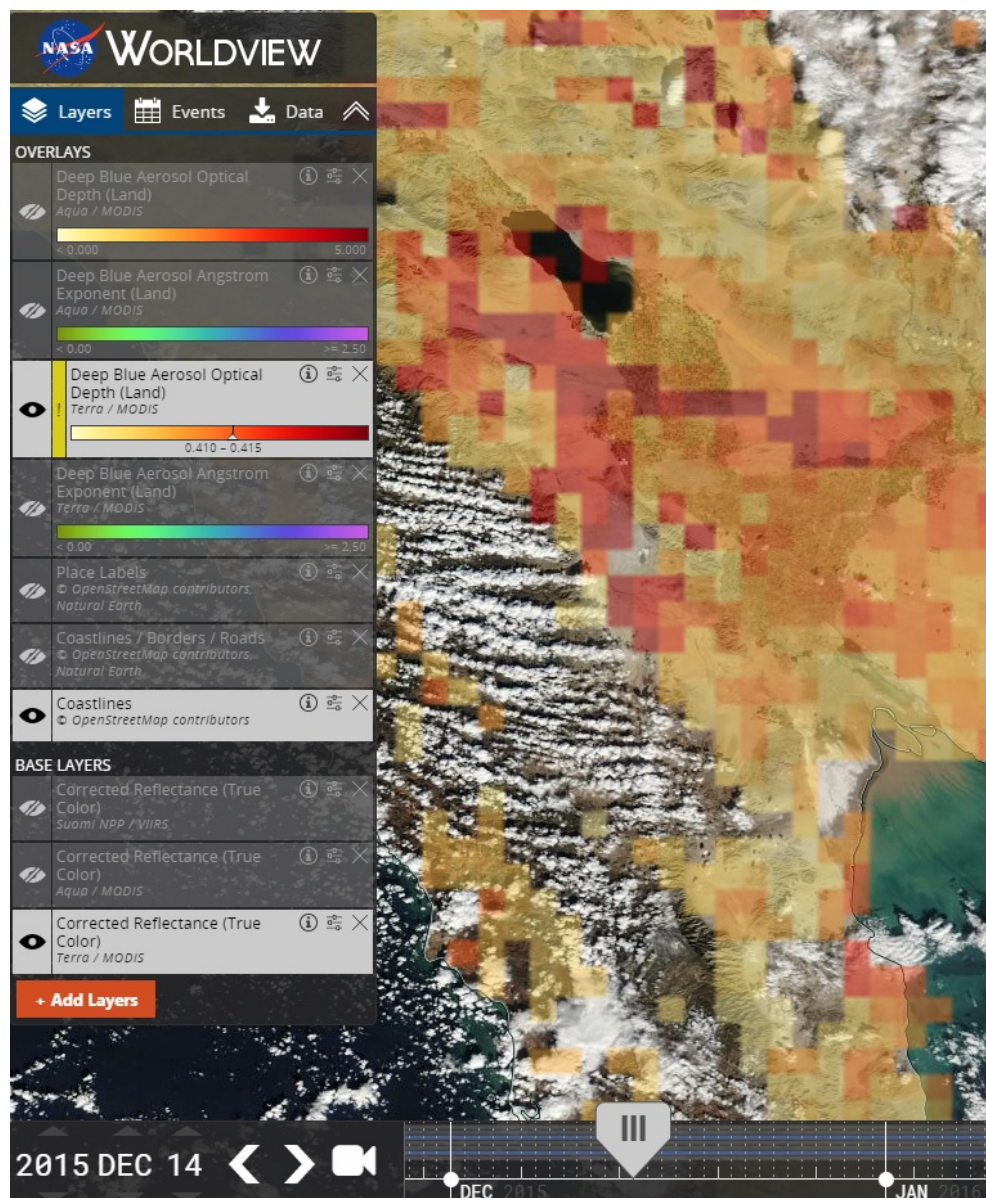


Fig 5-3: The MODIS instrument onboard the Terra satellite image (~1030 PST) captured heavy patches of aerosols over southeast California, southwest Arizona, and northern Mexico. Warmer layers indicate thicker layers of aerosols. Source: NASA Worldview; <http://worldview.earthdata.nasa.gov>

FIGURE 5-4
DUST LIKE AEROSOLS CAPTURED OVER SOUTHEAST CALIFORNIA

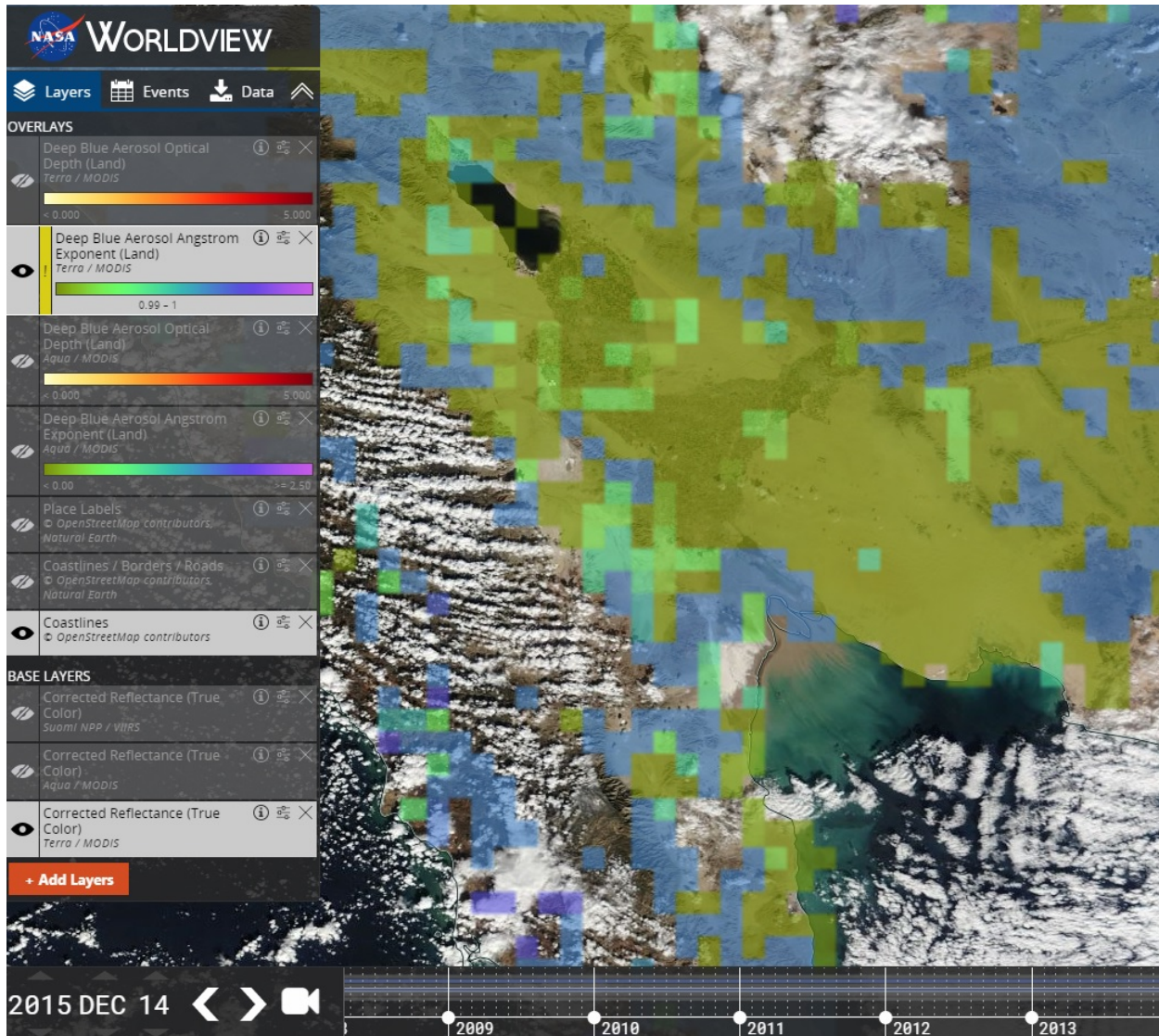


Fig 5-4: This image used the Deep Blue Angstrom Exponent layer to further discriminate the likelihood of dust-like aerosols being transported across southeast California, southwest Arizona, and northern Mexico. Increasingly darker shades of green colors indicate the increasingly larger sizes of aerosols that have a likelihood of being dust. See legend on left of image. Source: <https://worldview.earthdata.nasa.gov>

FIGURE 5-5
AEROSOL OPTICAL DEPTH OVER SOUTHEAST CALIFORNIA AQUA SATELLITE

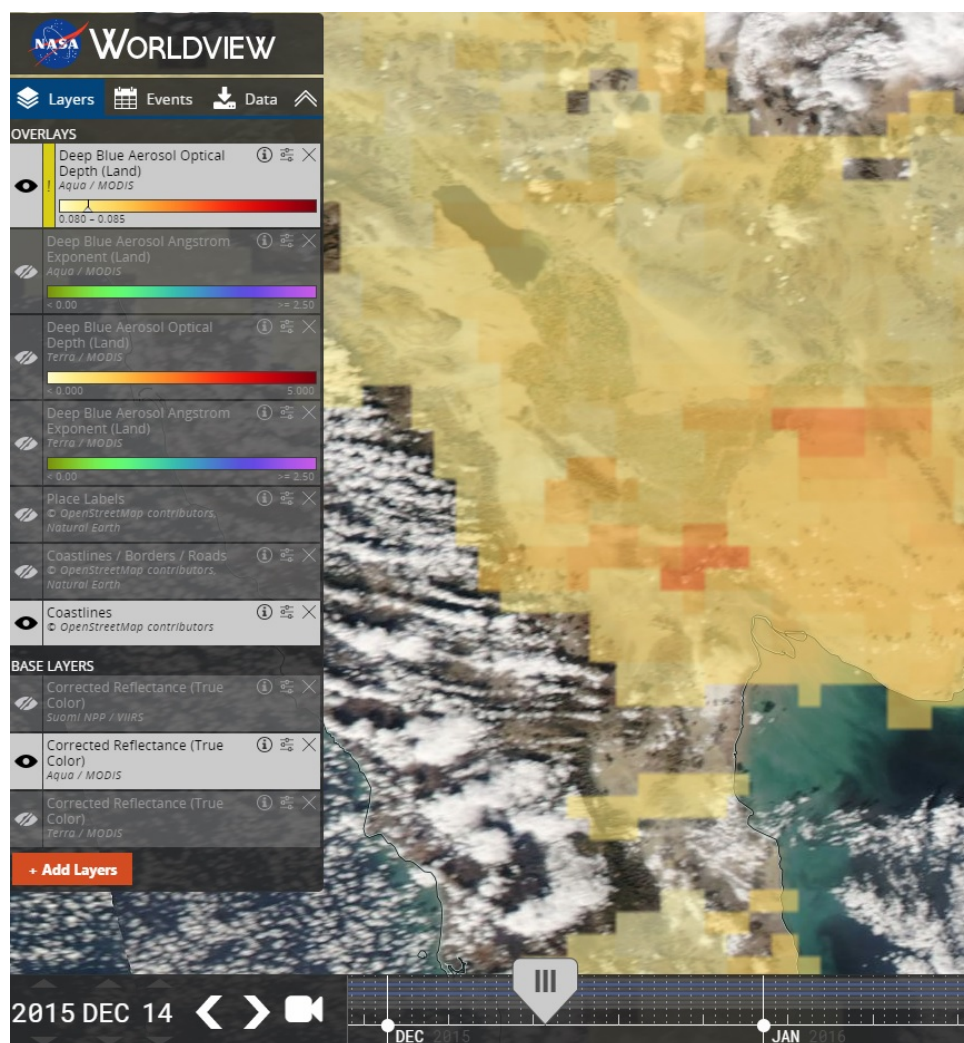


Fig 5-5: The MODIS instrument onboard the Aqua satellite captured moderately thick aerosols that were still over southeast California as late as 13:30 PST December 14. Although the aerosols had lessened since the morning when the Terra satellite made its pass, a moderately heavy layer of aerosols still persisted. Source: <https://worldview.earthdata.nasa.gov>

Supporting the identification of the thickness of the particles in the air as dust, the Smoke Text Product issued by NOAA's Satellite Services Division confirmed the existence of blowing dust. **Figure 5-6** is an excerpt of that notice. See **Appendix A** for the full notice.

FIGURE 5-6
DRIFTING DUST SAND OVER IMPERIAL COUNTY

A small area of light density blowing sand/dust was observed in Imperial county southwest of the Salton Sea in southern California. This area of blowing sand was traveling to the southeast into southwestern Arizona before becoming too diffuse to track.

Fig 5-6: A Smoke Text Product issued by NOAA's Smoke Text Product identified a plume of blowing dust/sand drifting southeast across Imperial County. Source: http://www.ssd.noaa.gov/PS/FIRE/2015_archive_smoke.html

The EPA accepts a high wind threshold for sustained winds of 25 mph in California and 12 other states.¹³ **Tables 5-1 through 5-4** provide a temporal relationship of wind speeds, wind direction, wind gusts (if available), and PM₁₀ concentrations at the exceeding stations. Winds began to increase during the final hours of December 13. The winds entrained and transported dust that was responsible for high hourly concentrations by midnight (0000 PST) on December 14, 2015. Therefore, the tables include the final three hours of December 13, 2015 to provide a more comprehensive understanding of the impact of the winds late on December 13, 2015. The monitors show that peak hourly concentrations following or during the period of high upstream wind speeds. The Brawley station does not have its own meteorological instruments, as does El Centro, Niland and Westmorland. Volcan Mountain measured strong westerly winds that blew across the mountains and down the desert slopes of San Diego County and into the desert floor of Imperial County. Many stations measured multiple hours of winds above the 25 mph threshold. The strong westerly winds entrained windblown dust toward Brawley, Niland, and Westmorland, elevating concentrations sufficiently to cause an exceedance.

¹³ "Treatment of Data Influenced by Exceptional Events; Final Guidance", FR Vol. 81, No. 191, 68279, October 3, 2016

TABLE 5-1
WIND SPEEDS AND PM₁₀ CONCENTRATIONS FOR BRAWLEY DECEMBER 14, 2015

	Sunrise-Ocotillo			Fish Creek Mtns.			El Centro NAF				Imperial Co. Airport			Ocotillo wells			Brawley
HOUR	W/S	W/D	W/G	W/S	W/D	W/G	W/S	W/D	W/G	Obs.	W/S	W/D	W/G	W/S	W/D	W/G	PM ₁₀ (µg/m ³)
21:00	11	248	25	8	26	26	22	230	38		16	210	32	20	329	38	23
22:00	12	256	23	3	19	19	31	220			7	VR	20	16	345	29	63
23:00	14	252	29	3	14	14	25	230			6	VR		17	326	28	332
00:00	19	298	35	16	30	30	28	230			26	250	36	27	340	46	882
01:00	25	295	40	11	39	39	18	270	31		18	300	28	31	320	55	813
02:00	25	298	48	23	47	47	24	270	31		20	270	30	32	292	54	
03:00	26	280	45	23	53	53	24	270	30		17	270	29	21	323	34	
04:00	13	287	30	18	33	33	16	250			15	250		21	330	35	441
05:00	20	291	32	13	39	39	17	350	24		15	300	24	19	351	32	787
06:00	15	288	24	12	34	34	17	300	28		21	300	29	15	326	28	593
07:00	25	275	39	4	22	22	21	290	30		22	280	30	15	306	26	327
08:00	18	269	33	9	25	25	26	280	36		25	290	33	19	319	33	100
09:00	25	280	38	18	34	34	37	280	45	BLDU	33	280	41	14	312	30	160
10:00	25	281	36	14	32	32	32	280	40	BLDU	29	270	37	20	338	30	98
11:00	20	273	30	13	33	33	25	270	32		23	270	29	16	341	26	53
12:00	14	285	25	11	26	26	25	270			18	300	25	14	326	25	52
13:00	12	290	20	14	31	31	21	270			20	270		18	303	30	75
14:00	16	278	26	14	25	25	18	270			15	280		14	291	27	50
15:00	12	270	20	12	23	23	20	280			11	300		13	303	25	45
16:00	13	271	22	10	21	21	18	280			11	290		12	312	22	21
17:00	9	272	15	9	19	19	17	270			13	280		9	309	19	25
18:00	9	265	16	9	21	21	14	250			13	250		9	316	15	22
19:00	10	250	16	8	19	19	8	230			9	240		11	300	18	16
20:00	9	248	13	11	15	15	9	250			9	240		9	300	15	8
21:00	10	247	16	8	17	17	10	230			7	250		10	315	17	6
22:00	10	243	14	9	14	14	7	260			8	270		9	293	14	7
23:00	9	245	14	2	15	15	5	300			7	280		7	348	13	9

Blue colors indicate December 13. Wind data for KIPL and KNJK from the NCEI's QCLCD system. Wind data for Fish Creek Mountains (IMPSD), Ocotillo Wells (AS398/KD6RSQ5), and Sunrise Ocotillo (IMPSD) from the University of Utah's MesoWest system. Wind speeds = mph; Direction = degrees. BLDU = blowing dust. VR = Variable. Because different stations measure with different instruments and at different times, correlated measurements are to the nearest hour

TABLE 5-2
WIND SPEEDS AND PM₁₀ CONCENTRATIONS FOR EL CENTRO DECEMBER 14, 2015

	Sunrise-Ocotillo			Fish Creek Mtns.			El Centro NAF				Imperial Co. Airport			Ocotillo wells			El Centro
HOUR	W/S	W/D	W/G	W/S	W/D	W/G	W/S	W/D	W/G	Obs.	W/S	W/D	W/G	W/S	W/D	W/G	PM ₁₀ (µg/m ³)
21:00	11	248	25	8	26	26	22	230	38		16	210	32	20	329	38	14
22:00	12	256	23	3	19	19	31	220			7	VR	20	16	345	29	9
23:00	14	252	29	3	14	14	25	230			6	VR		17	326	28	18
00:00	19	298	35	16	30	30	28	230			26	250	36	27	340	46	150
01:00	25	295	40	11	39	39	18	270	31		18	300	28	31	320	55	529
02:00	25	298	48	23	47	47	24	270	31		20	270	30	32	292	54	504
03:00	26	280	45	23	53	53	24	270	30		17	270	29	21	323	34	522
04:00	13	287	30	18	33	33	16	250			15	250		21	330	35	108
05:00	20	291	32	13	39	39	17	350	24		15	300	24	19	351	32	257
06:00	15	288	24	12	34	34	17	300	28		21	300	29	15	326	28	477
07:00	25	275	39	4	22	22	21	290	30		22	280	30	15	306	26	283
08:00	18	269	33	9	25	25	26	280	36		25	290	33	19	319	33	555
09:00	25	280	38	18	34	34	37	280	45	BLDU	33	280	41	14	312	30	671
10:00	25	281	36	14	32	32	32	280	40	BLDU	29	270	37	20	338	30	363
11:00	20	273	30	13	33	33	25	270	32		23	270	29	16	341	26	91
12:00	14	285	25	11	26	26	25	270			18	300	25	14	326	25	70
13:00	12	290	20	14	31	31	21	270			20	270		18	303	30	88
14:00	16	278	26	14	25	25	18	270			15	280		14	291	27	29
15:00	12	270	20	12	23	23	20	280			11	300		13	303	25	30
16:00	13	271	22	10	21	21	18	280			11	290		12	312	22	25
17:00	9	272	15	9	19	19	17	270			13	280		9	309	19	26
18:00	9	265	16	9	21	21	14	250			13	250		9	316	15	15
19:00	10	250	16	8	19	19	8	230			9	240		11	300	18	12
20:00	9	248	13	11	15	15	9	250			9	240		9	300	15	9
21:00	10	247	16	8	17	17	10	230			7	250		10	315	17	8
22:00	10	243	14	9	14	14	7	260			8	270		9	293	14	7
23:00	9	245	14	2	15	15	5	300			7	280		7	348	13	7

Blue colors indicate December 13. Wind data for KIPL and KNJK from the NCEI's QCLCD system. Wind data for Fish Creek Mountains (IMPSD), Ocotillo Wells (AS398/KD6RSQ5), and Sunrise Ocotillo (IMPSD) from the University of Utah's MesoWest system. Wind speeds = mph; Direction = degrees. BLDU = blowing dust. VR= Variable. Because different stations measure with different instruments and at different times, correlated measurements are to the nearest hour

TABLE 5-3
WIND SPEEDS AND PM₁₀ CONCENTRATIONS FOR NILAND DECEMBER 14, 2015

	Borrego Springs			Naval Test Base			El Centro NAF				Imperial Co. Airport			Niland			Niland
HOUR	W/S	W/D	W/G	W/S	W/D	W/G	W/S	W/D	W/G	Obs.	W/S	W/D	W/G	W/S	W/D	W/G	PM ₁₀ (µg/m ³)
21:00	11	23	23				22	230	38		16	210	32	11	134		33
22:00	21	37	37	3	116		31	220			7	VR	20	10	99		30
23:00	21	36	36				25	230			6	VR		8	134		79
00:00	10	31	31				28	230			26	250	36	19	259		
01:00	10	27	27				18	270	31		18	300	28	24	268		
02:00	11	26	26				24	270	31		20	270	30	27	258		
03:00	11	31	31				24	270	30		17	270	29	30	255		
04:00	11	27	27	25	276		16	250			15	250		21	265		197
05:00	3	8	8	18	282		17	350	24		15	300	24	20	279		33
06:00	9	17	17	20	270		17	300	28		21	300	29	19	276		96
07:00	10	28	28	19	282		21	290	30		22	280	30	18	277		135
08:00	15	38	38	21	285		26	280	36		25	290	33	12	273		12
09:00	15	26	26	22	278		37	280	45	BLDU	33	280	41	15	269		11
10:00	13	23	23	22	286		32	280	40	BLDU	29	270	37	10	275		9
11:00	13	21	21	20	283		25	270	32		23	270	29	8	268		9
12:00	13	21	21	22	282		25	270			18	300	25	11	278		18
13:00	11	18	18	21	278		21	270			20	270		10	263		20
14:00	9	25	25	20	274		18	270			15	280		16	272		18
15:00	11	17	17	21	274		20	280			11	300		16	267		14
16:00	12	17	17	22	282		18	280			11	290		16	268		19
17:00	6	10	10	20	283		17	270			13	280		14	278		16
18:00	7	12	12	17	292		14	250			13	250		7	279		7
19:00	3	7	7	14	294		8	230			9	240		5	303		10
20:00	3	7	7	13	295		9	250			9	240		2	19		9
21:00	2	5	5	14	289		10	230			7	250		4	100		12
22:00	4	5	5	13	288		7	260			8	270		7	85		16
23:00	1	2	2	12	278		5	300			7	280		4	86		7

Blue colors indicate December 13. Wind data for KIPL and KNJK from the NCEI's QCLCD system. Wind data for Fish Creek Mountains (IMPSD), Ocotillo Wells (AS398/KD6RSQ5), and Sunrise Ocotillo (IMPSD) from the University of Utah's MesoWest system. Wind speeds = mph; Direction = degrees. BLDU = blowing dust. VR = Variable. Because different stations measure with different instruments and at different times, correlated measurements are to the nearest hour. The 00:00 through 03:00 hours at Niland were invalidated

TABLE 5-4
WIND SPEEDS AND PM₁₀ CONCENTRATIONS FOR WESTMORLAND DECEMBER 14, 2015

	Borrego Springs			Naval Test Base			El Centro NAF				Imperial Co. Airport			Westmorland			Westmorland
HOUR	W/S	W/D	W/G	W/S	W/D	W/G	W/S	W/D	W/G	Obs.	W/S	W/D	W/G	W/S	W/D	W/G	PM ₁₀ (µg/m ³)
21:00	11	23	23				22	230	38		16	210	32	9	198		13
22:00	21	37	37	3	116		31	220			7	VR	20	10	197		24
23:00	21	36	36				25	230			6	VR		11	230		402
00:00	10	31	31				28	230			26	250	36	12	284		404
01:00	10	27	27				18	270	31		18	300	28	18	291		272
02:00	11	26	26				24	270	31		20	270	30	16	289		430
03:00	11	31	31				24	270	30		17	270	29	18	283		984
04:00	11	27	27	25	276		16	250			15	250		19	283		
05:00	3	8	8	18	282		17	350	24		15	300	24	21	292		736
06:00	9	17	17	20	270		17	300	28		21	300	29	18	278		
07:00	10	28	28	19	282		21	290	30		22	280	30	13	285		367
08:00	15	38	38	21	285		26	280	36		25	290	33	13	297		143
09:00	15	26	26	22	278		37	280	45	BLDU	33	280	41	17	293		28
10:00	13	23	23	22	286		32	280	40	BLDU	29	270	37	17	292		181
11:00	13	21	21	20	283		25	270	32		23	270	29	15	289		103
12:00	13	21	21	22	282		25	270			18	300	25	16	291		60
13:00	11	18	18	21	278		21	270			20	270		14	285		66
14:00	9	25	25	20	274		18	270			15	280		14	280		55
15:00	11	17	17	21	274		20	280			11	300		13	285		43
16:00	12	17	17	22	282		18	280			11	290		12	284		21
17:00	6	10	10	20	283		17	270			13	280		12	283		19
18:00	7	12	12	17	292		14	250			13	250		9	278		29
19:00	3	7	7	14	294		8	230			9	240		5	271		40
20:00	3	7	7	13	295		9	250			9	240		4	252		16
21:00	2	5	5	14	289		10	230			7	250		7	272		13
22:00	4	5	5	13	288		7	260			8	270		5	268		11
23:00	1	2	2	12	278		5	300			7	280		5	287		8

Blue colors indicate December 13. Wind data for KIPL and KNJK from the NCEI's QCLCD system. Wind data for Fish Creek Mountains (IMPSD), Ocotillo Wells (AS398/KD6RSQ5), and Sunrise Ocotillo (IMPSD) from the University of Utah's MesoWest system. Wind speeds = mph; Direction = degrees. BLDU = blowing dust. VR= Variable. Because different stations measure with different instruments and at different times, correlated measurements are to the nearest hour

Figures 5-7 and 5-8 are graphical depictions that combine the HYSPLIT trajectories, upstream wind speeds and important peak concentration times. As early as December 13, 2015 elevated gusty westerly winds blew across the mountains of San Diego County and down the desert slopes at points like Fish Creek Mountain and into Imperial County.

According to meteorological data collected from Imperial County Airport (KIPL) and El Centro NAF (KNJK), wind modestly elevated, accompanied by occasional strong gusts during the late afternoon of December 13, 2015 in a southwest direction. By the evening hours of December 13, 2015 KNJK measured six hours of winds at or above 25 mph coincident with elevated concentrations at the Brawley and Westmorland monitors. Upstream locations roughly to the west and west-southwest of El Centro, Brawley, Westmorland, and Niland, measured strong winds and gusts through the morning of December 14, 2015. Both local airports, Imperial County (KIPL) and El Centro NAF (KNJK), measured strong winds and powerful gusts during the early morning hours on December 14, 2015 as winds shifted to a more predominant west, followed soon after to a NNW to NW direction coincident with the elevated concentrations at the El Centro, Brawley, Westmorland and Niland monitors. Winds and gusts continued to elevate well into the late morning hours. By noontime winds declined coincident with the decline in concentrations at all monitors. On December 14, 2015, KNJK had six hours of winds at or above the 25 mph threshold, while KIPL had four hours of winds at or above the 25 mph threshold.

On December 14, 2015 all monitors, FRM and FEM, measured exceedances of the NAAQS, except for Niland and Calexico. The Niland monitor more than likely would have exceeded had the monitor not failed critical criteria requirements, causing the invalidation of four am hours. The Calexico monitor failed to run as there was no continuous FEM monitor in Calexico it is unclear if Calexico would have exceeded the NAAQS.

FIGURE 5-7
EXCEEDANCE FACTORS 0500 PST DECEMBER 14, 2015

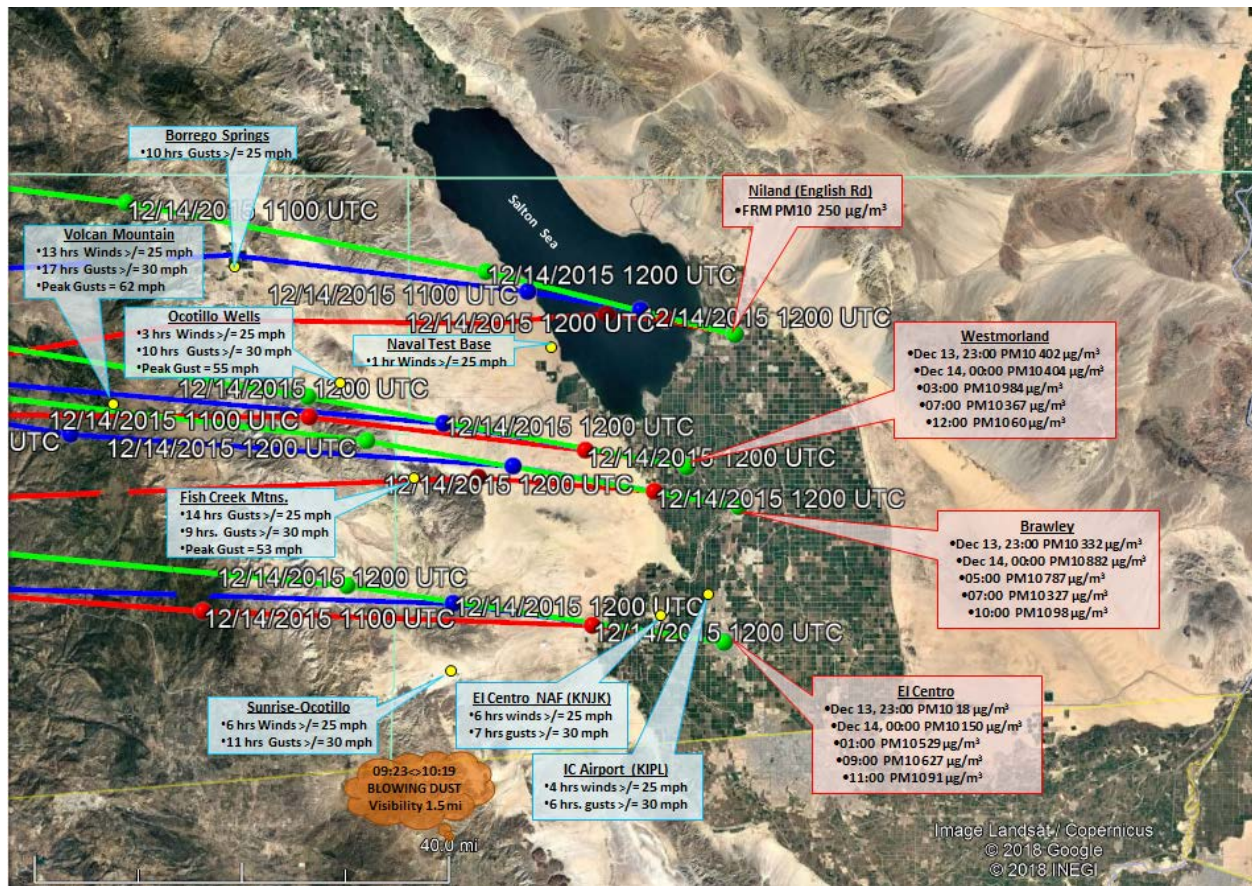


Fig 5-7: The path of the airflow is depicted with eight-hour back-trajectories ending at 0500 at Brawley, El Centro, Niland, and Westmorland. This was during the middle of the event when the monitors continued to measure elevated PM₁₀ concentrations for several hours. High winds and gusts at upstream locations blew through the San Diego mountains and desert slopes across the desert floor and agricultural lands in Imperial County. Red lines indicate airflow up to 10 meters AGL (above ground level); blue lines are 100 meters AGL; green lines are 500 meters AGL. Google Earth base map

FIGURE 5-8
EXCEEDANCE FACTORS 1000 PST DECEMBER 14, 2015

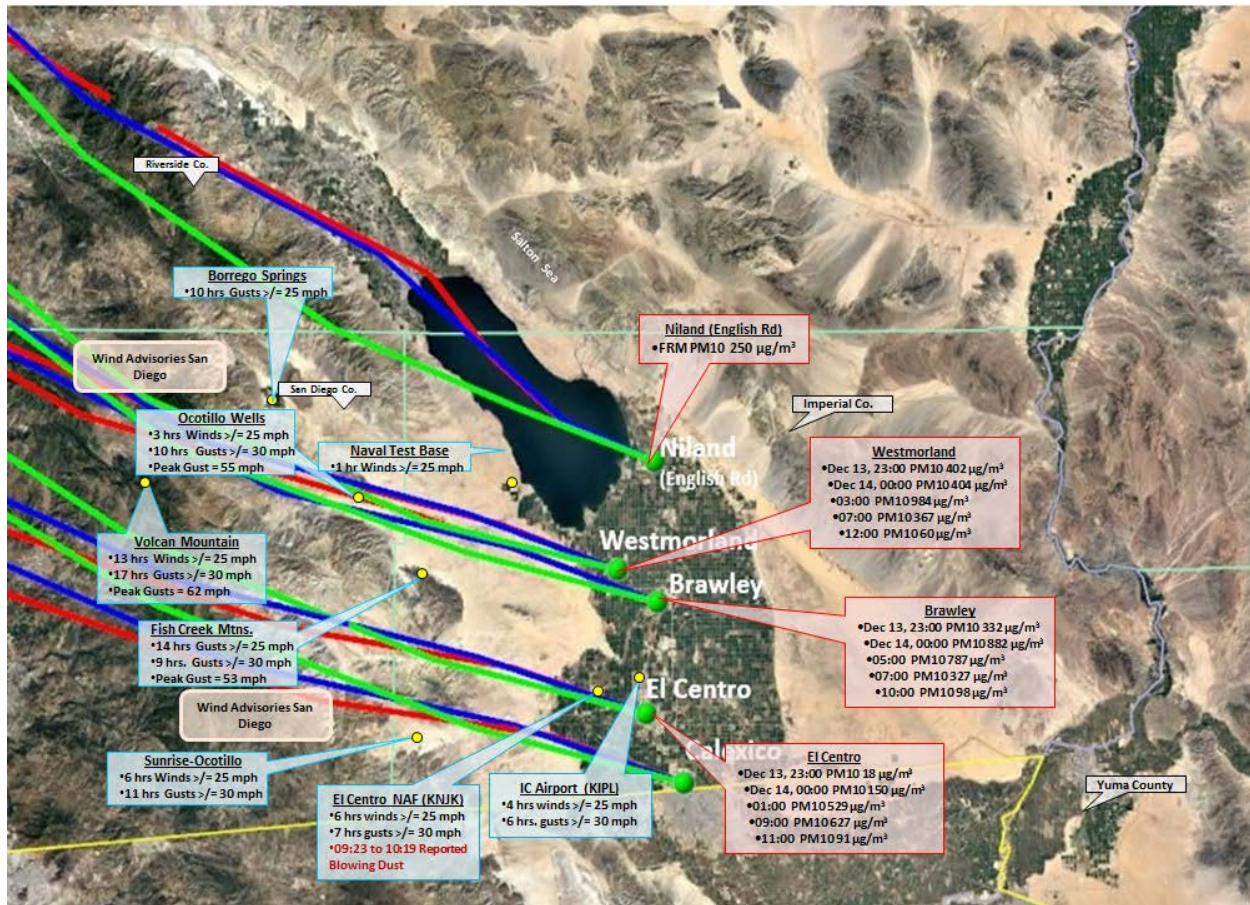


Fig 5-8: The path of the airflow is depicted with 12-hour back-trajectories ending at 10:00 at Brawley, El Centro, Niland, and Westmorland. This was towards the end of the continued measured elevated PM₁₀ concentrations. High winds and gusts at upstream locations blew through the San Diego mountains and desert slopes across the desert floor and agricultural lands in Imperial County. Red lines indicate airflow up to 10 meters AGL (above ground level); blue lines are 100 meters AGL; green lines are 500 meters AGL. Google Earth base map

Figures 5-9 through 5-12 depict PM₁₀ concentrations and wind speeds over a 72-hour period at Brawley, El Centro, Niland, and Westmorland. Fluctuations in hourly PM concentrations at the stations show a positive correlation with wind speeds, and gusts, at upstream wind sites.

FIGURE 5-9
BRAWLEY PM₁₀ CONCENTRATIONS AND WIND SPEED CORRELATION

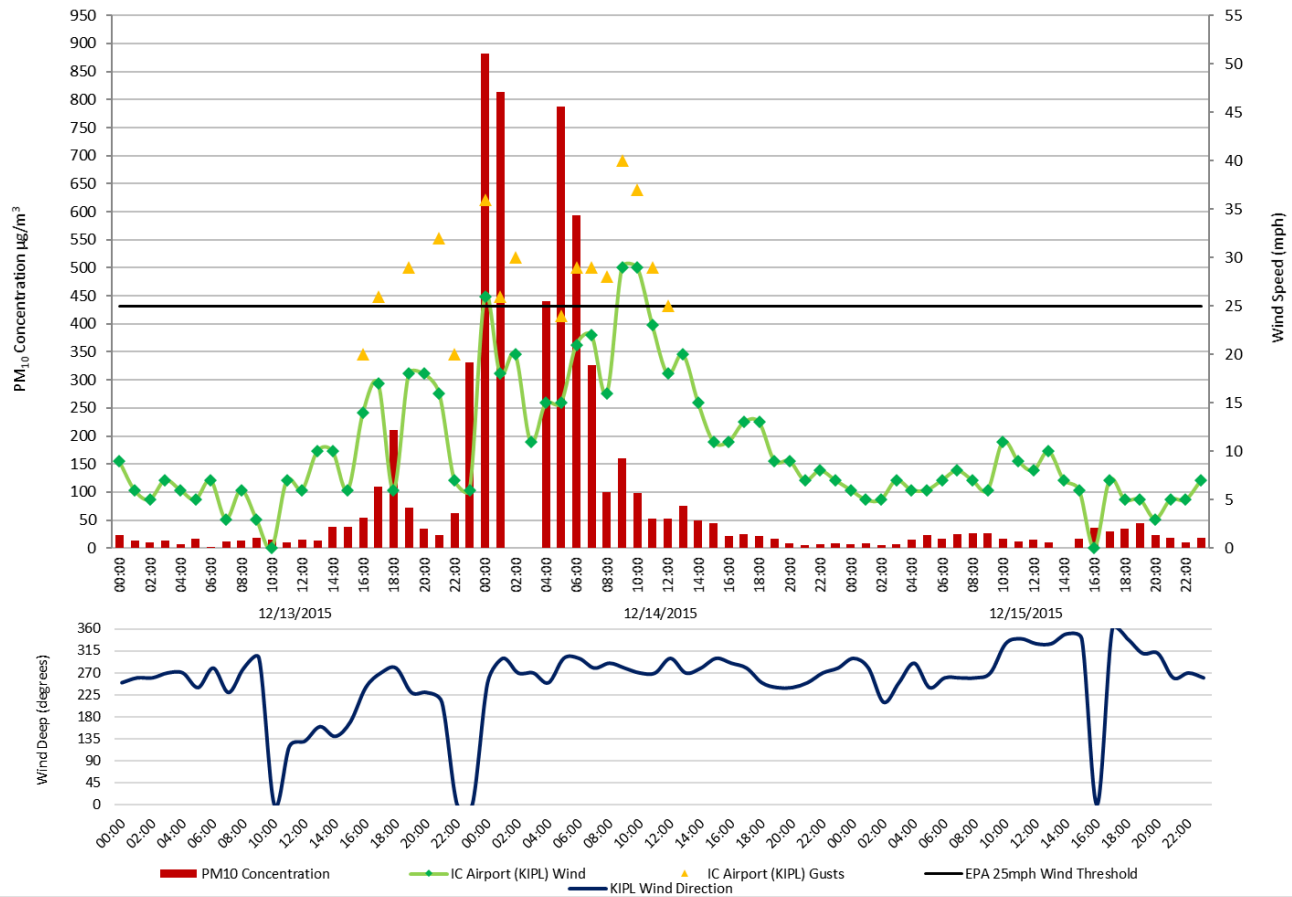


Fig 5-9: Brawley PM₁₀ concentrations show a positive correlation with high winds that impacted the area. Imperial County Airport wind data utilized as Brawley does not measure wind

FIGURE 5-10
EL CENTRO PM₁₀ CONCENTRATIONS AND WIND SPEED CORRELATION

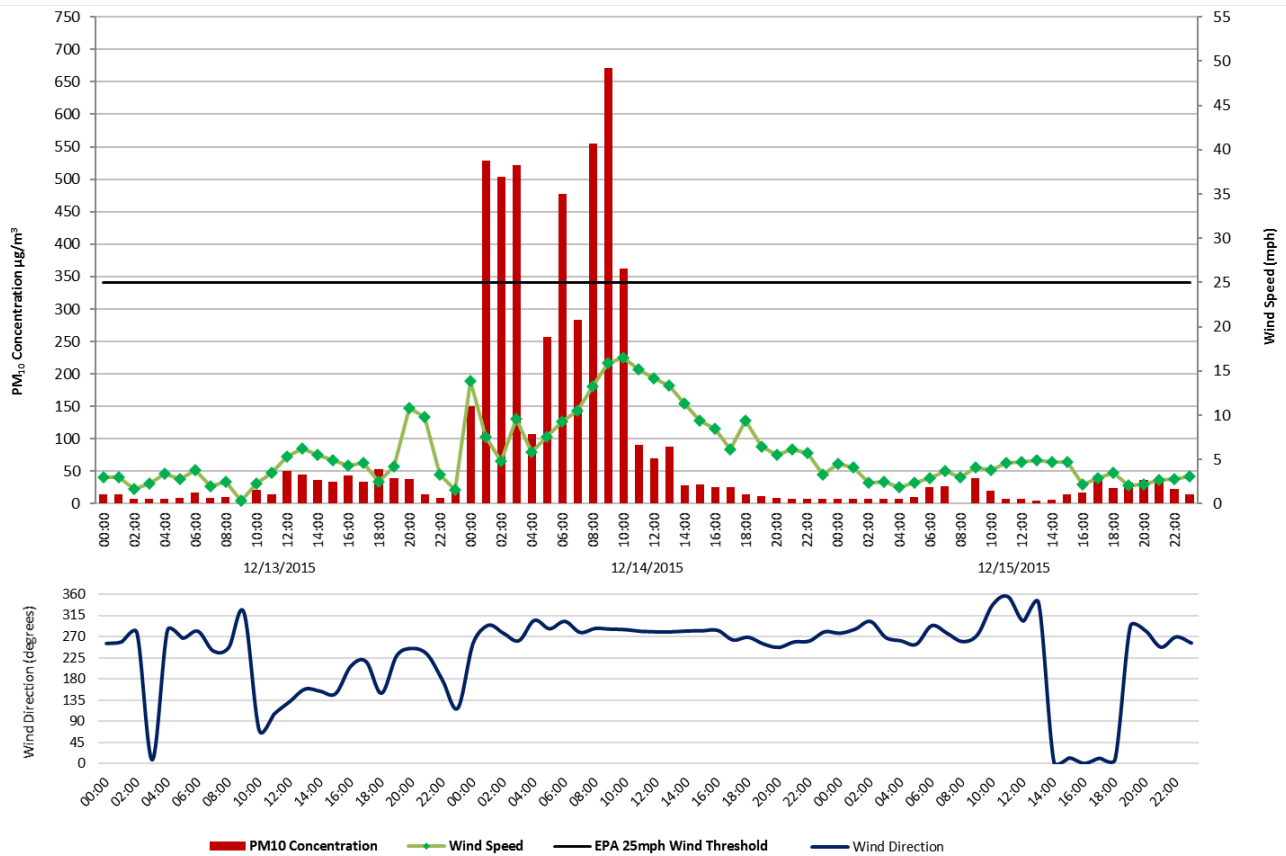


Fig 5-10: El Centro PM₁₀ concentrations show a positive correlation with high winds that impacted the area. Although winds at El Centro did not reach 25 mph, the lower wind speeds at the station allowed dust entrained upstream to be deposited on the monitor. El Centro air and wind data from the EPA's AQS data bank

FIGURE 5-11
NILAND PM₁₀ CONCENTRATIONS AND WIND SPEED CORRELATION

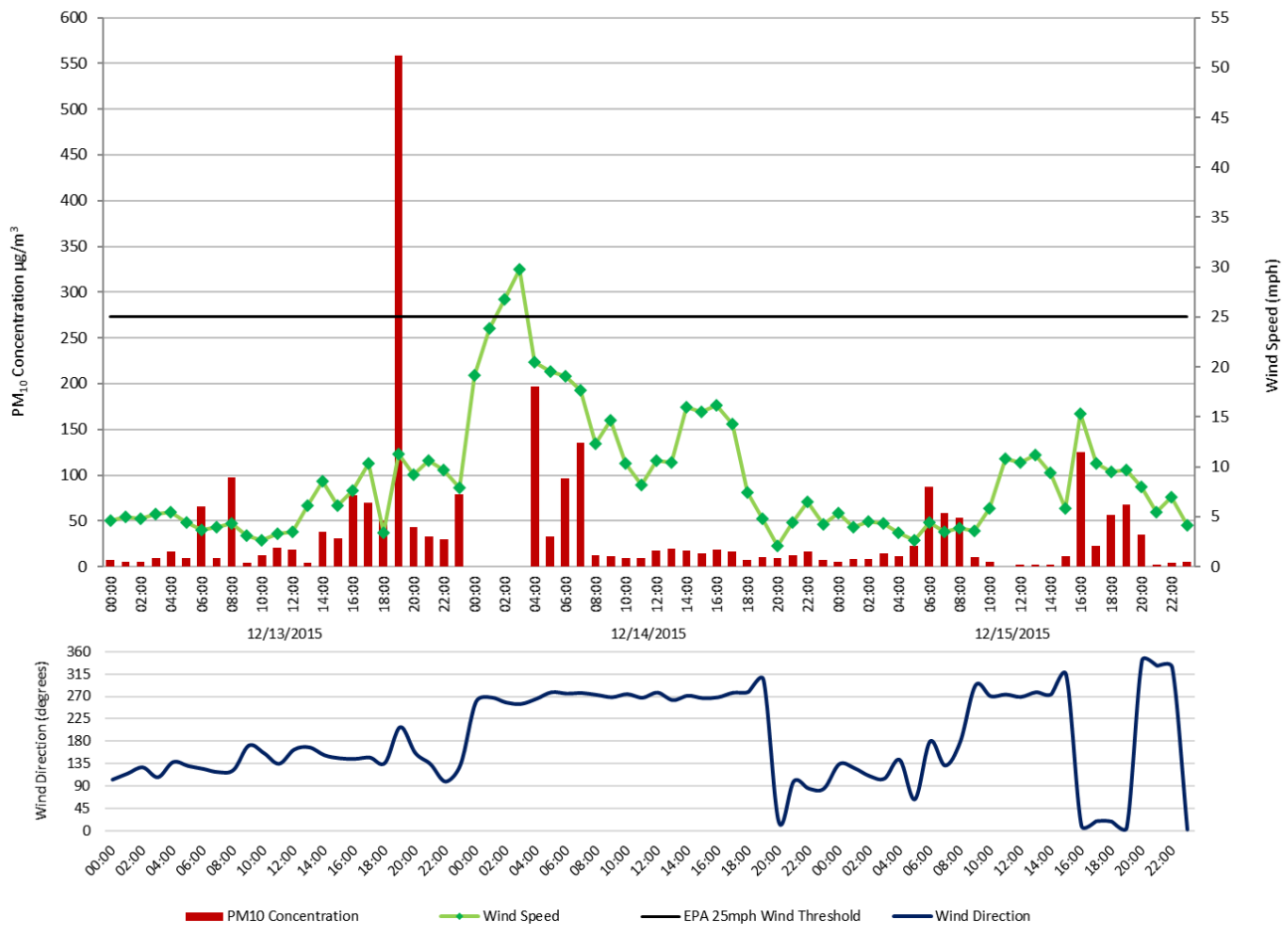


Fig 5-11: Niland PM₁₀ concentrations would show a stronger positive correlation with high winds that impacted the area, if not for four critical hours of data missing during an increase in high winds on December 14, 2015. Air and wind data from the EPA's AQS data bank

FIGURE 5-12
WESTMORLAND PM₁₀ CONCENTRATIONS AND WIND SPEED CORRELATION

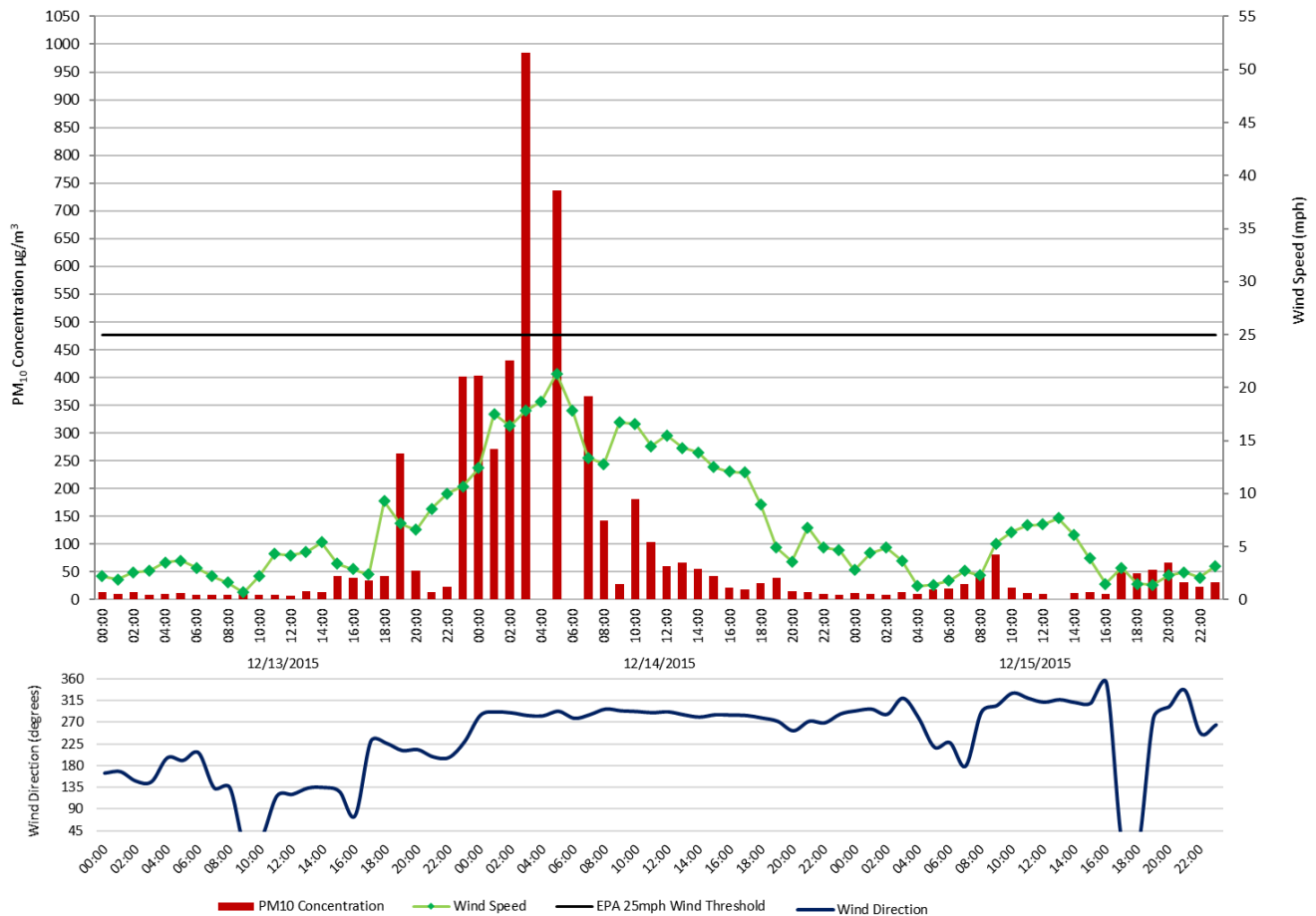


Fig 5-12: Westmorland PM₁₀ concentrations show a positive correlation with high winds that impacted the area. Although winds at Westmorland did not reach 25 mph, the lower wind speeds at the station allowed dust entrained upstream to be deposited on the monitor. Westmorland air and wind data from the EPA's AQS data bank

Figure 5-13 depicts the relationship between the 72-hour PM₁₀ fluctuations by the Brawley, El Centro, Niland, and Westmorland monitors together with upstream wind speeds. A positive correlation is evident between the elevated concentrations of PM and elevated wind speeds, particularly with gusts, at all sites. **Appendix C** contains additional graphs illustrating the relationship between PM₁₀ concentrations and wind speeds from region monitoring sites within Imperial County, eastern Riverside County, and Yuma, Arizona during the wind event.

FIGURE 5-13
BRAWLEY, EL CENTRO, WESTMORLAND AND NILAND
PM₁₀ CONCENTRATION AND WIND SPEED

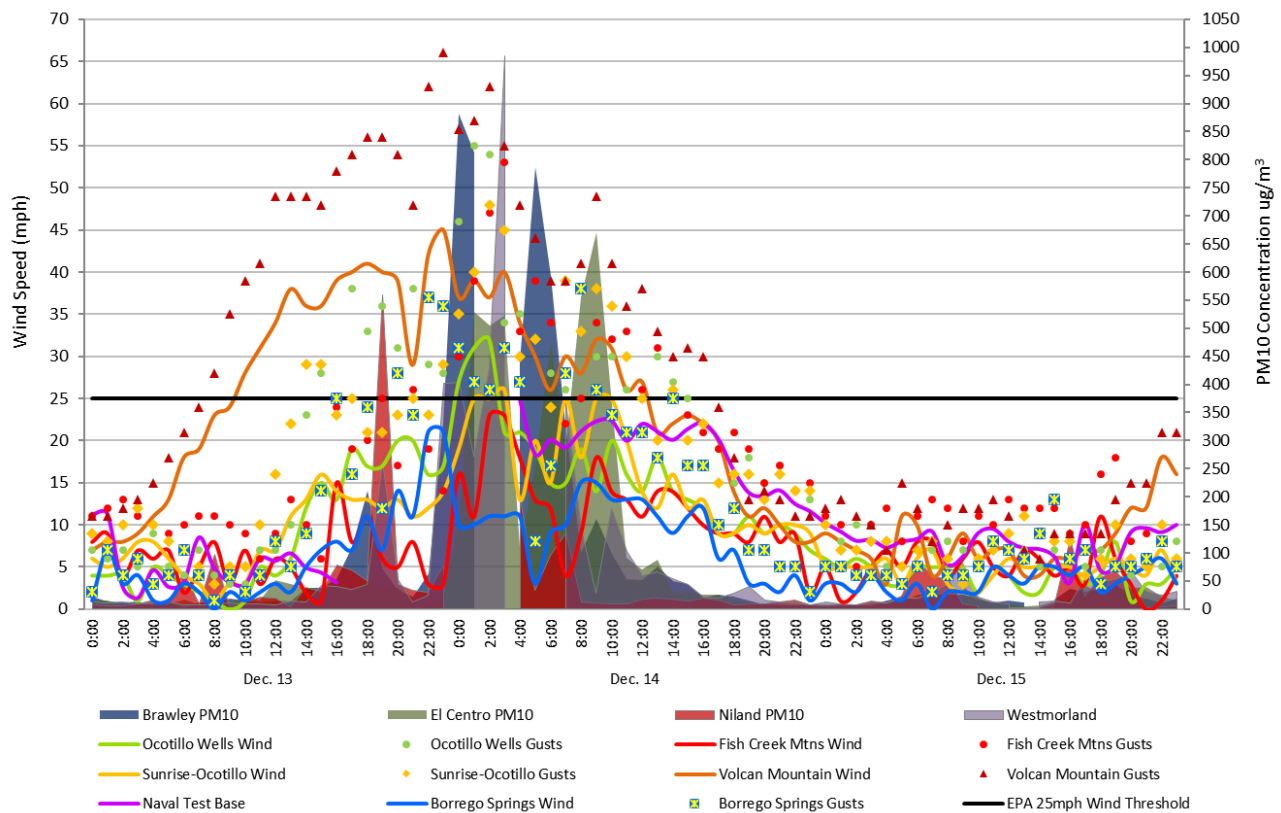


Fig 5-13: This graph illustrates the concentration levels of the four sites that measured exceedances, correlated to the wind speeds at Imperial County Airport (KIPL) and El Centro NAF (KNJK), the two main airports in Imperial County. Dashed line for Niland is for visual purposes only, and should not infer interpolation of data

Figure 5-14 compares the 72-hour concentrations at Brawley, El Centro, Niland, and Westmorland between December 13, 2015 and December 15, 2015. Visibility¹⁴ at Imperial County Airport (KIPL) reduced significantly starting around midnight on December 14, 2015 and experiencing periodic rises and falls until about 1000.

¹⁴ According to the NWS there is a difference between human visibility and the visibility measured by an Automated Surface Observing System (ASOS) or an Automated Weather Observing System (AWOS). The automated sensors measure clarity of the air vs. how far one can “see”. The more moisture, dust, snow, rain, or particles in the light beam the more light scattered. The sensor measures the return every 30 seconds. The visibility value transmitted is the average 1-minute value from the past 10 minutes. The sensor samples only a small segment of the atmosphere, 0.75 feet therefore an algorithm is used to provide a representative visibility. Siting of the visibility sensor is critical and large areas should provide multiple sensors to provide a representative observation; <http://www.nws.noaa.gov/asos/vsby.htm>

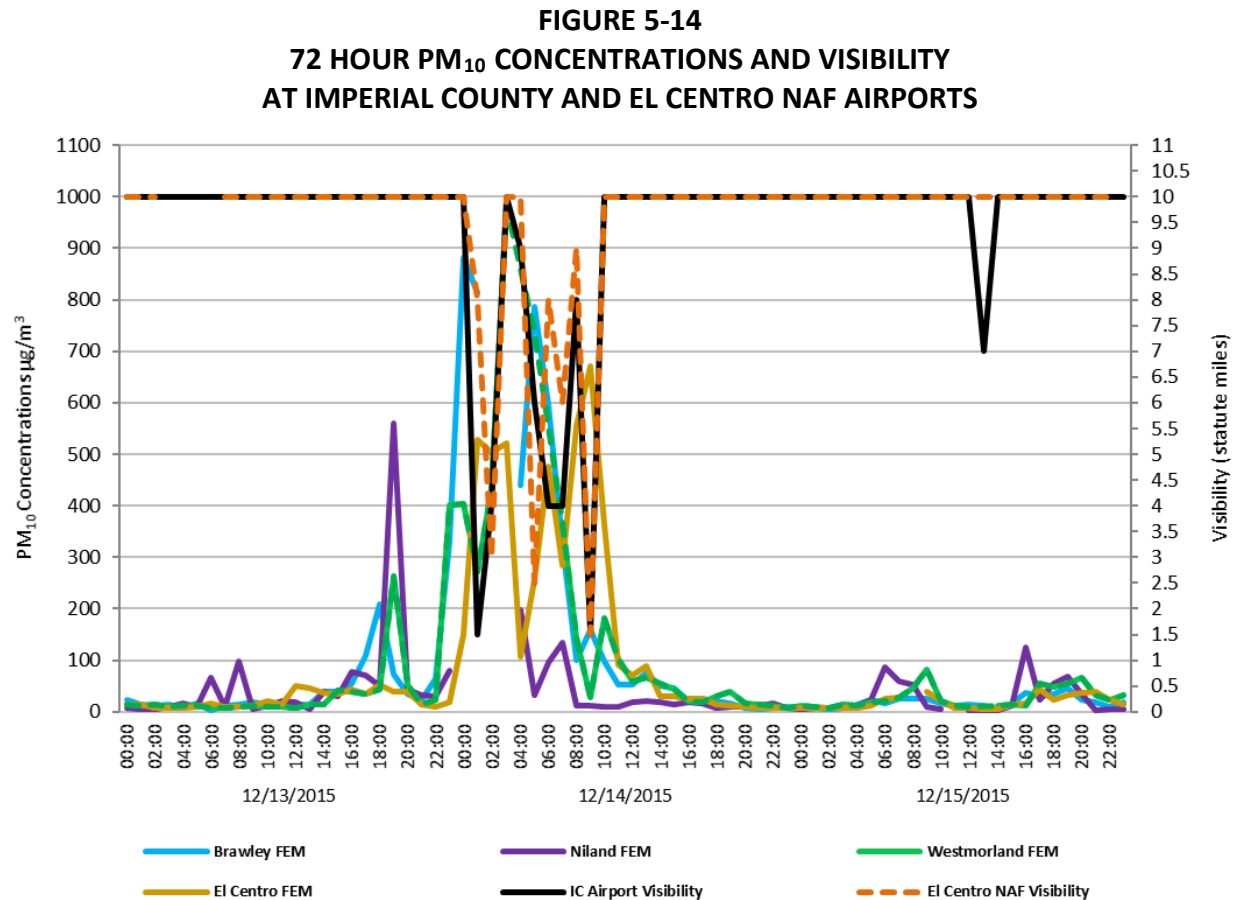


Fig 5-14: Illustrates the observed visibility level on December 14, 2015, as reported from Imperial County Airport and El Centro NAF. All stations show a comparable pattern between elevated PM₁₀ levels and visibility

The intensity of the unsettled weather prompted the San Diego and Phoenix NWS offices to issue either Weather Briefings, Urgent Weather Messages and/or Special Weather Statements for areas with San Diego County, including the mountains and deserts and Imperial County. As discussed earlier, as early as December 12, 2015 the San Diego NWS office identified a second winter-like storm system, one of two, developing out of the Pacific Northwest for Sunday December 13, 2015, which would move through Southern California Sunday evening through Monday morning.

By December 13, 2015 the expected cold front was well defined and was expected to create fairly strong and gusty westerly winds within the San Diego mountain slopes and deserts. The first Urgent Weather Message, issued by the San Diego NWS office at 1:41 PST identified southwest to west winds 20 to 30 mph with gusts to 45 mph with hazardous travel warning along Interstate 10 and Interstate 8. In total, the San Diego NWS office issued five Urgent Weather messages through December 14, 2015. The release of preliminary and final Public Statements confirmed strong winds along and within the mountain passes and desert slopes ranging between 40 mph

and 59 mph. The NWS office in Phoenix issued on December 14, 2015 a single Special Weather Statement indicating a deep and cold low-pressure system bringing widespread cold temperatures.

Figure 5-15 is the resultant Air Quality Index¹⁵ (AQI) for December 14, 2015. The Air Quality Index for December 14, 2015 was in the “Green” or Good category at 1 a.m. The AQI rose to the Moderate or “Yellow” category from 2 a.m. to 6 a.m. The AQI rose to the Unhealthy for Sensitive Groups or “Orange” category from 7 a.m. to 12 a.m. confirming, that the fugitive dust transported by high winds had impacted the quality of air in Imperial County.

FIGURE 5-15
AIR QUALITY INDEX FOR BRAWLEY DECEMBER 14, 2015
Site Detail: Brawley - 220 Main Street
 Air Quality Index for each hour of the day for **December 14, 2015**

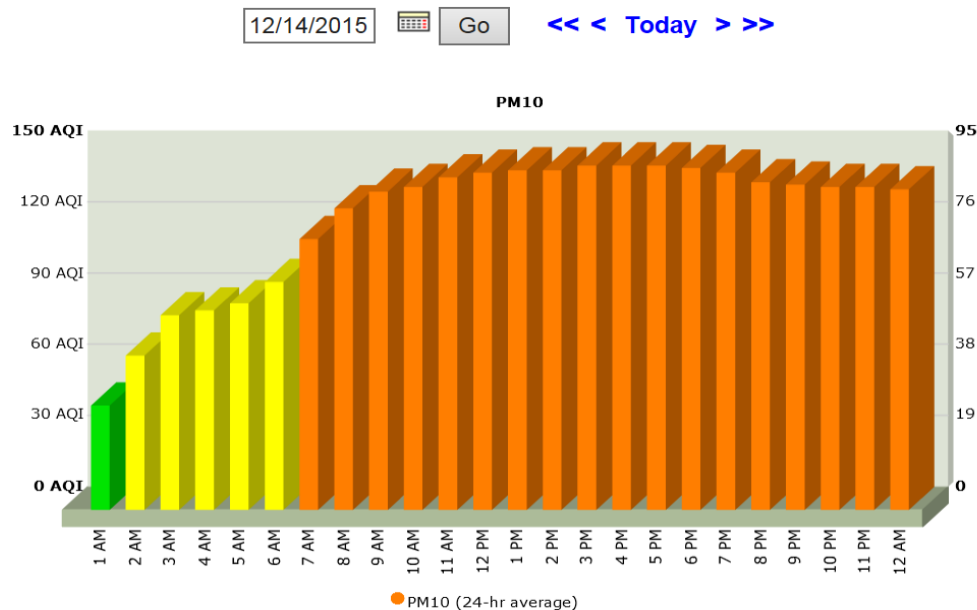


Fig 5-15: Demonstrates that air quality in Imperial County was affected when high winds generated by the passage of a low pressure system moved through southern California and lofted dust, impacting the Imperial County monitors on December 14, 2015

¹⁵ The AQI is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects you may experience within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health. Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in this country. Source: <https://airnow.gov/index.cfm?action=aqibasics.aqi>.

V.2 Summary

The preceding discussion, graphs, figures, and tables provide wind direction, speed and concentration data illustrating the spatial and temporal effects of the steep pressure gradient accompanying the low-pressure system that passed through the southern region of California. The information provides a clear causal relationship between the entrained windblown dust and the PM₁₀ exceedance measured at the Brawley, El Centro, Westmorland and Niland monitors on December 14, 2015. Furthermore, the advisories and air quality index illustrate the affect upon air quality within the region extending from the mountains and desert slopes of San Diego County, all of Imperial County and the southern portion of Riverside County. Large amounts of coarse particles (dust) and PM₁₀ transported by strong westerly winds into the lower atmosphere caused a change in the air quality conditions within Imperial County. The entrained windblown dust originated from as far as the mountains and desert slope areas located within San Diego County and Imperial County (part of the Sonoran Desert). Combined, the information demonstrates that the elevated PM₁₀ concentrations measured on December 13, 2015, coincided with high wind speeds and that gusty west winds experienced over the southern portion of Riverside County, southeastern San Diego County, all of Imperial County, and parts of Arizona.

FIGURE 5-16
DECEMBER 14, 2015 WIND EVENT TAKEAWAY POINTS

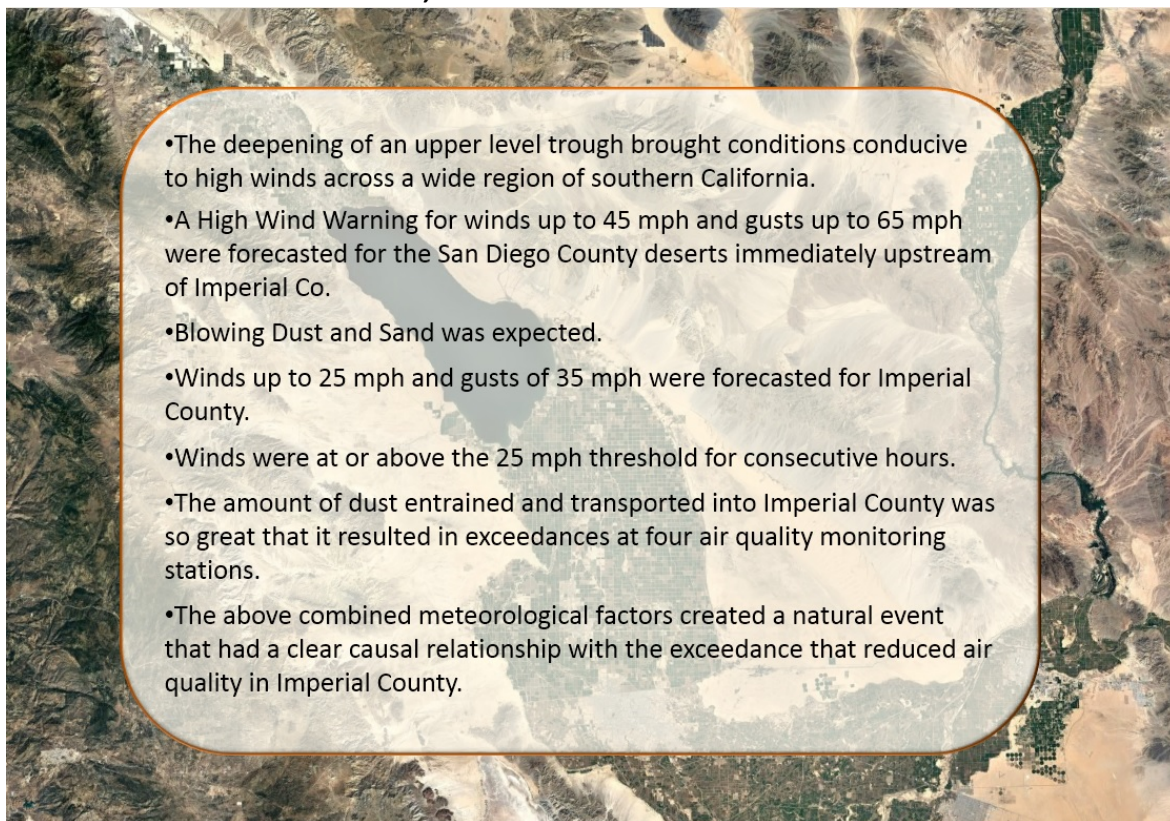


Fig 5-16: Illustrates the factors that qualify the December 14, 2015 natural event which

affected air quality as an Exceptional Event

VI Conclusions

The PM₁₀ exceedance that occurred on December 14, 2015 satisfies the criteria of the EER which states that in order to justify the exclusion of air quality monitoring data evidence must be provided for the following elements:

TABLE 6-1 TECHNICAL ELEMENTS CHECKLIST		
EXCEPTIONAL EVENT DEMONSTRATION FOR HIGH WIND DUST EVENT (PM ₁₀)		DOCUMENT SECTION
1	A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	Pgs. 6-32
2	A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation	Pgs. 52-69
3	Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the requirement at paragraph (c)(3)(iv)(B) of this section	Pgs. 34-42
4	A demonstration that the event was both not reasonably controllable and not reasonably preventable	Pgs. 44-51
5	A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event	Pgs. 21-31; 49-51

VI.1 Affects Air Quality

The preamble to the revised EER states that an event is considered to have affected air quality if it can be demonstrated that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation. Given the information presented in this demonstration, particularly Section V, we can reasonably conclude that there exists a clear causal relationship between the monitored exceedance and the December 14, 2015 event, which changed or affected air quality in Imperial County.

VI.2 Not Reasonably Controllable or Preventable

In order for an event to be defined as an exceptional event under section 50.1(j) of 40 CFR Part 50 an event must be “not reasonably controllable or preventable.” The revised preamble explains that the nRCP has two prongs, not reasonably preventable and not reasonably controllable. The nRCP is met for natural events where high wind events entrain dust from desert areas, whose sources are controlled by BACM, where human activity played little or no direct causal role. This demonstration provides evidence that despite BACM in place within Imperial County, high winds overwhelmed all BACM controls where human activity played little to no

direct causal role. The PM₁₀ exceedance measured at the Brawley, Westmorland, and Niland monitors were caused by naturally occurring strong gusty west winds that transported windblown dust into Imperial County and other parts of southern California from areas located within the Sonoran Desert regions to the west and southwest of Imperial County. These facts provide strong evidence that the PM₁₀ exceedances at Brawley, El Centro, Westmorland, and Niland on December 14, 2015, were not reasonably controllable or preventable.

VI.3 Natural Event

The revised preamble to the EER clarifies that a “Natural Event” (50.1(k) of 40 CFR Part 50) is an event with its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. Anthropogenic sources that are reasonably controlled are considered not to play a direct role in causing emissions. As discussed within this demonstration, the PM₁₀ exceedances that occurred at Brawley, El Centro, Westmorland, and Niland on December 14, 2015, were caused by the transport of windblown dust into Imperial County by strong westerly winds associated with the passage of low-pressure system and accompanying trough that moved through the region. At the time of the event, anthropogenic sources were reasonably controlled with BACM. The event therefore qualifies as a natural event.

VI.4 Clear Causal Relationship

The time series plots of PM₁₀ concentrations at Brawley, El Centro, Westmorland, and Niland during different days and the comparative analysis of different monitors in Imperial and Riverside Counties demonstrates a consistency of elevated gusty west winds and concentrations of PM₁₀ on December 14, 2015 (Section V). In addition, these time series plots and graphs demonstrate that the high PM₁₀ concentrations and the gusty west winds were an event that was widespread, regional and not preventable. Arid conditions preceding the event resulted in soils that were particularly susceptible to particulate suspension by the elevated gusty west winds. Days immediately before and after the high wind event PM₁₀ concentrations were well below the NAAQS. Overall, the demonstration provides evidence of the strong correlation between the natural event and the entrained fugitive emissions to the exceedances on December 14, 2015.

VI.5 Historical Concentrations

The historical annual and seasonal 24-hr average PM₁₀ values measured at the Brawley, El Centro, Westmorland and Niland monitors were historically unusual compared to a multi-year data set (Section III).

Appendix A: Public Notification that a potential event was occurring (40 CFR §50.14(c)(1)(i))

This section contains wind advisories issued by the National Weather Service and Imperial County on or around December 14, 2015. In addition, this Appendix contains the air quality alert issued by Imperial County advising sensitive receptors of potentially unhealthy conditions in Imperial County resulting from the strong gusty winds. The data show a region-wide increase in wind

speeds and wind gusts coincident with the arrival of dust and high PM₁₀ concentrations in Imperial County. In addition, the **Appendix A supplemental** contains all the NWS notices issued by either the San Diego or Phoenix office by date and time order

Appendix B: Meteorological Data

This Appendix contains the time series plots, graphs, wind roses, etc. for selected monitors in Imperial and Riverside Counties. These plots, graphs and tables demonstrate the regional impact of the wind event.

Appendix C: Correlated PM₁₀ Concentrations and Winds

This Appendix contains the graphs depicting the correlations between PM₁₀ Concentrations and elevated wind speeds for selected monitors in Imperial and Riverside Counties. These graphs demonstrate the region wide impact of the wind event.

Appendix D: Regulation VIII – Fugitive Dust Rule

This Appendix contains the compilation of the BACM adopted by the Imperial County Air Pollution Control District and approved by the United States Environmental Protection Agency. A total of seven rules numbered 800 through 806 comprise the set of Regulation VIII Fugitive Dust Rules.